Factors Affecting Selection and Performance of Insulators—
Symposium on Burning Low Grade Fuel—and Other Operating Subjects

NOV 12 1917 Engineering Library

Electrical World

New York, November 10, 1917 McGraw-Hill Publishing Co., Inc. Vol. 70, No. 19 10c a copy

For Active Service

From a purely scientific standpoint this Company is proud of its contributions to the *theory* of Electrical Measurement. It is still more proud of

Weston

Indicating Electrical Measuring Instruments

In design, in material, in their structural perfection, they are thoroughly worthy to represent Weston ideas and ideals in the field of active service.

Model 341 A.C. and D.C. Portable Voltmeter

This group also comprises Model 310 Single Phase and D. C. Wattmeter, Model 329 Polyphase Wattmeter and Model 370 A. C. and D. C. Ammeter.

Weston Models include complete groups for Portable and for Switchboard Service on A. C. and on D. C. circuits, together with many instruments designed for special purposes. Write for particulars regarding any field.

Weston Electrical Instrument Co.
13 Weston Avenue, Newark, N. J.

New York	Boston	Chicago	San Francisco	Montreal
Buffalo	Philadelphia	St. Louis	Toronto	London
Cleveland	Pittsburgh	Detroit	Winnipeg	Paris
Cincinnati	Richmond	Denver	Vancouver	Petrograd
	Florence,	Johannesburg, South Africa		

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN
Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70 NEW YORK, SATURDAY, NOVEMBER 10, 1917 No. 19

Opportunity and the Central Station

THE remarkable expansion of business in the industries at this time due to the war, with the accompanying importance of uninterrupted service and the scarcity of coal, has forced industrial plants to adopt central station service on an unparalleled scale. In some quarters this has led to very unusual demands on given central stations, and the emergency has demonstrated probably as never before the fundamental importance of the central station as a factor in the industrial development of the country. In his article on "Central Station Power for the Industries" Professor Clewell takes occasion to emphasize this particular phase of the industrial power problem at the present time and also points out the many corresponding advantages of such service in normal times as well.

The average central station is inclined to view the field of power supply to industrial plants from its own particular point of view, which is concerned with the restrictions which must of necessity be placed on various classes of service, depending on such factors as the starting current and starting conditions, the power factor of the load, the size of the units to be employed, the type and voltages of the motors and the hours of service. Such a viewpoint is likely, however, in itself to overlook the other side of the question, which is related so closely to the organization of the industrial plant and which involves the requirements of the user of the power.

In his analysis of the situation, therefore, Professor Clewell takes occasion to point out the factors in the problem from the standpoint of the industries rather than that of the central station; but it is quite apparent that at the same time this other side of the question is in reality intimately related to the interests of the central station, because to obtain an enlarged hold on this field the central station must not only devote its energies to a study of the ways and means for supplying each special case which arises but must also be in a position to demonstrate to each industry in a convincing manner just why central station power is an advantage in comparison with that from the small isolated plants so often found in conjunction with the industry.

Moreover, while the trend in the purchase of central station power in the past in such typical cases as the machinery building trades has shown a steady increase, it is, as pointed out in the article, unsafe to base conclusions as to this tendency on records even of a very few years past. Present unusual factors brought about by the war have confronted the central stations of this country with a large problem in the handling of emergency demands for industries which have expanded or have developed as new fields; but—and this is almost equally important—this situation presents an opportunity of tremendous possibilities for demonstrating beyond any doubt whatever to the industries that the central station, as the embodiment of specialized effort in the manufacture of electric power, is capable of furnishing a more efficient and reliable supply than is possible through any other channel.

How to Save the Coal

A FORCEFUL letter from W. W. Nichols which we publish in another column gets down to the very fundamentals of the fuel-saving problem. Here we are, facing a war which optimists think may be over in a year or two and pessimists in a decade, with transportation already somewhat crippled by the necessities of war material, labor making unprecedented demands and scarce under any and all circumstances, vital industries hard pushed for fuel, and the government considering the abolition of luxuries. On the other hand, as Mr. Nichols points out, there is about 10,000,000 hp. in water of which the development is already projected. When developed, he shows that this amount of energy would imply a saving of 8,000,000 tons of coal or about 240,000,000 barrels of oil per annum, with the transfer to other uses necessary to the war of some thousands of locomotives and scores of thousands of railway cars, not to say the concomitant labor of certainly more than half a million men. The one vital thing is that federal legislation should realize the vast store of "white coal" ready for use and no longer lock it up while still desperately striving to mine and transport the coal it would render unnecessary. If this be conservation, let us have no more of it.

Even France, with less than half this water power at its command, is taking hold of the problem of developing it to eke out with transmitted energy the scanty supply of coal left by the invader or brought from friendly countries. The average American, by the way, would be astounded to know of the number of small developments of electric power along the streams of France which were already in operation before the war—streams utilized with a completeness which puts our best efforts to shame. What is to be done for the relief of the fuel situation by the development of water powers needs to be done quickly. Of the 10,000,000 hp. available only a modest proportion could be pushed into service within the next year, but every horsepower so won is an industrial gain. There is no excuse for culpable complicity in hoarding up the resources of a nation when the nation is at war, and we should have

the legislation at once as a war measure which, in justice, has been long overdue during times of peace.

We have the resources and we want to use them. Depletion of coal reserves and waste of water power are badly mated policies. Legislative impediments to true conservation have spread weariness over the entire country in the past. Lost in a bewilderment of committees and cross-currents of opinion on details, the great principles of conservation which are really vital to our national interest are still waiting for recognition at Washington. Congress can act quickly. Its legislation on the war was put on the statute books after delays that seemed to have no end but were in reality much shorter than the usual requirement of time. The final action on necessary war measures shows that the national legislative body will act when it is conscious of a serious public crisis. It is our place to point out the critical nature of the crisis.

Merging the British Power Networks

WE HAVE from time to time called attention to the efforts made in England to amplify and unify the large power generating systems which have been inaugurated. The value of widely ramifying distributions is, of course, fully appreciated everywhere, but in England, with a relatively small area, with meager water powers and yet with enormous industrial demands, the organization of a comprehensive scheme of power distribution rises to particular importance. A report has just been issued on the interconnection of the Lancashire and Cheshire electricity supply systems which touches on some very important matters, both technical and industrial. In both these regions there is a large amount of transmission from central power stations. The union of the two systems, the unification of their distribution networks and the improvement of their efficiency are matters of vital importance industrially, and the lesson gained from the study of the matter in England is of no small value in helping us meet our conditions here. The technical details of the arrangements are not yet worked out. The constitution of the networks is so far very imperfect, but both of the districts concerned seem to be keenly interested in following up the work to a successful conclusion.

At the present time the majority of electric undertakings in this particular territory are operated by municipal authorities. Some of the largest and best equipped English stations are thus working, and the prices charged for energy for industrial purposes have been made very reasonable. To carry out the complete project of unification it is necessary that some provision should be made by which all the municipal as well as private plants should pull together without too much disturbance of the principles of local self-government and yet in accordance with a well-defined plan. The propositions now brought forward are that throughout the entire territory a joint board representing the local authorities and the interests of private companies shall be constituted, and that to this board shall be given general authority for regulating certain features of the enterprise. For instance, it would, through the respective local representatives, arrange the running hours of existing stations to obtain the best results; that is, it should have control over the load-dispatching system, so that this system may render the best possible service. The board should also determine the basis of charges to be made between various stations and regulate administrative expenses and charges incurred in proper linkage of the systems in the connected networks. It should have authority, in fact, at least in an advisory way, over the amounts necessary in future extensions, over working arrangements between power companies and local authorities and between various local authorities, and should form sub-committees dealing with special phases of the matter. Much of the proposed work would be done through district boards having the closest possible relations with individual plants and markets.

The constitution of this proposed board is rather interesting. On it the private companies now operating would be represented in proportion to their respective capital outlay and the local authorities would be represented in proportion to the population of the territory served. At present thirty-five authorized distributers and local authorities would be concerned in the united project and the total membership of the resulting board would be ninety. This sounds like a somewhat unwieldy organization, and the importance of powers locally delegated therefore stands out conspicuously. The general scheme of organizing the power transmission supply of two adjacent counties in the fullest possible manner requires no demonstration of its importance. It is the more vital since the power is generated by steam and so much depends on the thorough working out of load distribution. The diversity factor rises to large importance, and on account of the varied industries supplied the load wandering throughout the twenty-four hours becomes an important matter in securing the much-sought-for maximum economy of distribution.

That if successfully carried through the project will increase the efficiency of generation and distribution is quite obvious; but that the numerous enterprises involved can be made to pull harmoniously together even under act of Parliament may be considered a little dubious. It is open to question whether better results would not be obtained by an actual merger of the several properties under private control with government supervision. A practically common ownership with a single responsible administration would seem more likely to get results quickly and efficiently than a town meeting of local authorities. Municipal undertakings have had a fair measure of success in England, far more than has been accorded to them here, yet in an area of two counties there are serious chances for disagreements not easily to be soothed by a majority vote of a board constituted as is now proposed. A far closer union of interests would strike us as necessary to the best operative results.

Experience with Low-Grade Fuels

WE have repeatedly voiced the need of studying furnace conditions with a view to utilizing fuel of minimum cost for the output. War conditions have emphasized the necessity for activity in this respect, and we are glad to be able to give in the current issue some important reports from some of the automatic stoker companies as to their success in burning cheap fuel with existing equipment. The reports show that under the pressure of necessity almost every available kind of low-grade fuel is to a certain extent being utilized, and with good results. The list includes the poorer soft coals, lignite, coke breeze, culm, anthracite screenings, and in fact the refuse of the mines. Several questions come to the front when considering the use of these cheap fuels. Some of them have a fairly high thermal value measured in pound-Fahrenheit units but are inconvenient because of ash, clinkers or moisture. Moreover, considering the fact that every plant has a fixed grate surface, the output of steam is limited by the quality of the fuel, and where a plant is pushed near to its capacity when burning standard steam coal it will come out badly with poor coal even though the latter may be cheap and of very fair thermal value.

Consequently in going to cheap fuel it may be necessary to increase the boiler plant if this can be conveniently done, or to make changes in the furnaces of a somewhat sweeping character. However, in a large number of instances the existing equipment can be used very well. With a little attention to detail existing stokers can be made to handle cheap fuel, and a new installation can be very readily adapted to burning it with first-class results. As to the former case, in some plants a moderate proportion of cheap anthracite mixed with bituminous coal has been found to work perfectly well in the stokers, although ordinarily they are not planned for anthracite. Lignite is being worked successfully, and in favorable locations a good many stokers are being installed for this purpose. Some of the fuel runs as low as 6500 heat units and is still consumed at fair efficiency. In several instances bone coal with ash running up as high as 40 per cent has been dealt with by unchanged stokers with good economy. In one plant the increased consumption in tons was only 25 per cent, and the change released 100 tons of good marketable coal per day. Coke breeze, where it is obtainable from coke ovens or gas houses or by-product plants, seems to be giving favorable results, although from the peculiar consistency of this fuel and the amount of moisture it is likely to accumulate, some modifications in the stoker mechanism are desirable, particularly in the way of better air supply and special arrangements for pushing along the fuel. In some coals which are apt to clinker moving retort side walls and special forms of air supply have been found desirable. Anthracite screenings can with care be used successfully either by themselves or else mixed with bituminous coal.

The chief difficulty in dealing with all this low-grade fuel, much of which carries a very high percentage of ash, is the danger of forming clinkers on the side walls or grates. To overcome this various devices are used and all of them apparently with a measurable degree of success. Some trouble has been reported with the firebrick in these various experiments, particularly where the arch construction is used, and divers schemes in furnace construction are employed to get around these specific troubles. Each stoker company has its own line of remedies for low-grade fuel troubles, based on its judgment and experience; but the encouraging point of the situation is that in general good results are being reached despite minor difficulties. Each plant has its own problems to solve, depending on the available fuel, the possibility of holding its output without unnecessary increase of furnace capacity, and the chance of readily adapting its stoking apparatus to its changed duty.

A general effort to make the best of the cheap fuel readily attainable will produce admirable results in loosening up the general coal situation. Transportation seems to be the chief difficulty in getting coal supply for various industrial purposes, and it must be remembered that low-grade fuel of whatever kind puts a much stiffer burden on transportation than high-grade fuel, both in weight and bulk, to an extent that is by no means of small consequence. We have heard much recently, for instance, of the use of wood for domestic and other purposes as a substitute for coal. Now, all questions of cost and labor aside, in which the balance is heavily against wood, for a given thermal value wood weighs roughly twice as much and also takes four times as many cars as coal, thereby using up rolling stock and increasing the dead weight to be hauled. It therefore behooves those who are studying the use of low-grade fuel to be guided largely by its availability as well as its character, utilizing locally produced fuel wherever possible. None the less, speaking broadly, a marked degree of success is being reached, and in the aggregate a very large quantity of high-grade coal will be released for long hauls and for purposes where it is peculiarly necessary.

The Coming Issues

AMONG the articles which will be contained in the next issue of the ELECTRICAL WORLD will be one on obtaining the approximate values of harmonics, another on standardization of 33,000-volt outdoor substations, and the third installment of Prof. C. E. Clewell's series on industrial motor applications. The latter will dwell on the method of making and using records of factory circuits, important aspects of circuit standardization, and interrelations between lighting and motor loads. In a future issue of the ELECTRICAL WORLD there will be published a discussion by an authority in the jobbing industry on the present credit situation and the outlook for the future.

Symposium on Utilization of Low-Grade Fuels

Advisability of Electric Companies Ascertaining Nearby Sources—Many Forms of Mine Refuse Have Been Burned Successfully—Some of the Problems That Are Involved

OWING to the present high prices and poor delivery of the grades of coal which have been most popular for steam-producing purposes, a number of electrical companies are now using poorer grades of fuel than heretofore. Other companies which cannot afford to reduce their boiler capacity, which would

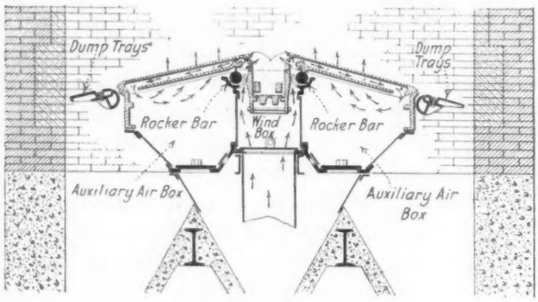


FIG. 1—ROCKING-BAR STOKER IN WHICH FUEL IS FED FROM MIDDLE AND CARRIED TO THE SIDES (COMBUSTION ENGINEERING COMPANY)

necessarily result from using lower-grade fuel, are mixing a large percentage of coke breeze and hard coal screenings with their regular fuel, thereby endeavoring to reduce the consumption of the scarcer fuel and permitting utilization of the more readily obtainable fuels. Still other companies, especially those in England, are considering the practicability of generating gas from coal for boiler firing and either marketing the by-products or disposing of them to some separate concern which will find a sale for them. Whichever method is followed, the companies find it best to co-operate with the mines and railroads in securing coal at times best suited to them, namely, in the summer, providing storage facilities so that coal can be kept until used. Where oil is used it may be necessary to change to powdered coal if the price of oil increases, says one of the electric service companies on the Pacific Coast.

Under present conditions the problem is not so much to secure the largest number of kilowatt-hours per pound of coal as it is to find the fuel that can be utilized without making too many changes in the existing equipment and to provide for the continuous delivery of this fuel. Judging by what the companies heard from are doing, it appears that many other utilities, confronted with the fuel problem, could profit by ascertaining the low-grade fuels in their vicinity and if necessary modifying their equipment so that these low grades could be used. If this cannot be done, or is impracticable, the present method of operation could be carefully analyzed to determine where the losses are and how they may be reduced. When it is considered that before the war the average fuel expense was only 0.42 cent per kilowatt-hour in a 5000-kw. plant, while at present it has advanced to 0.67 cent per kilowatt-hour, it should be evident that as much heat as possible should be converted into useful work.

According to reports from electric service companies and manufacturers of stoking apparatus, many types of low-grade fuel are being successfully burned. Among them are the soft coal with high ash content, bone coal, culm, lignite, coke breeze, anthracite screenings, and in fact all mine refuse. Before changing from the grade of coal used at the present time, however, each company should carefully analyze the problems which will be involved in utilizing lower-grade fuel. In this connection it should be pointed out that the steam output developed from a given size of grate will not be as large with a low-grade fuel as with a higher grade, even though the unit cost may be less. Furthermore, the moisture absorbed by low-grade fuels in transit should be taken into consideration, as it may be considerable, 25 per cent increase in weight due to moisture absorption being not unusual. Another problem, and probably the most serious, is that the use of low-grade fuels brings about difficulties in regard to clinkers, draft and fusing of firebrick.

The reports given below indicate what success stoker manufacturers have had in burning low-grade fuel with existing apparatus, and how standard equipment has been modified in some cases where it is necessary.

American Engineering Company.—Ordinarily this company does not install stokers to burn anthracite coal; however, it is being burned successfully where it is being mixed with a relatively large quantity of bituminous coal. A number of installations burn coke breeze from beehive ovens, by-products plants and gas houses. The best results have been obtained with by-product breeze, although this fuel runs somewhat

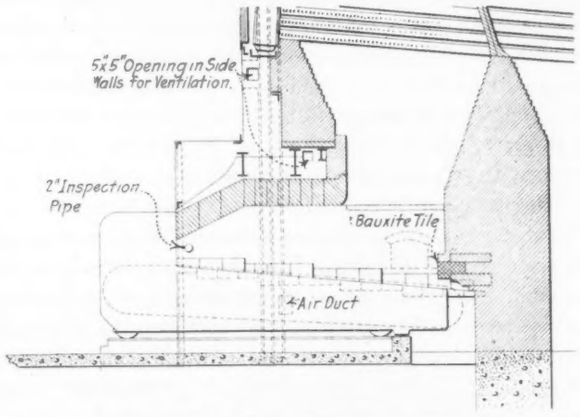


FIG. 2—CHAIN-GRATE STOKER WITH SOME FEATURES OF FURNACE CONSTRUCTION RECOMMENDED BY THE LACLEDE-CHRISTY COMPANY

lower in calorific value and higher in moisture than any other form of breeze. Lignite has been burned and is being burned, a large number of stokers being installed at the present time for burning this fuel. The lignite chiefly used in these stokers ranges in calorific value from 6500 to 9000 B.t.u. This is being burned in large amounts and with relative efficiency.

Bessemer Coal & Coke Company, Russellton, Pa.—This plant used bone coal, which contains 36 to 49 per cent ash and has a heating value ranging from 8000 to 9000 B.t.u. The boilers are set in pairs, with one three-retort stoker serving each battery. No modifications have been made in the construction of the stokers. Previous to installing the stokers eight boilers were required to carry the load and 100 tons of

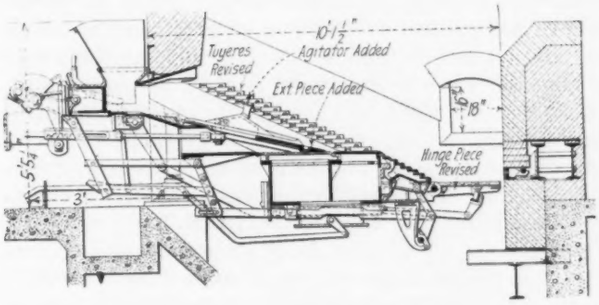


FIG. 3—STANDARD UNDERFEED STOKER WITH EXCEPTION OF COKE-BREEZE PUSHERS (AMERICAN ENGINEERING COMPANY)

marketable coal were consumed per day. After installing the stokers six boilers were sufficient to carry the load and 125 tons of bone coal were consumed per day. This method of operation released considerable marketable coal and increased the mine production by 75 per cent.

Iowa Railway & Light Company.—Iowa coal, containing approximately 30 per cent ash with a heating value of 8500 to 9500 B.t.u., is used almost exclusively in the boiler room of this plant. This fuel is non-coking and quick-burning and its ash has a very low fusing temperature. The stoker is standard except for the addition of a lower-ram extension which is used for maintaining a uniform feed of coal from the mouth of the retort throughout the length of the furnace. In burning this coal it is important that the dumping periods should be regular and not extended too long a period. (Test data in accompanying table.)

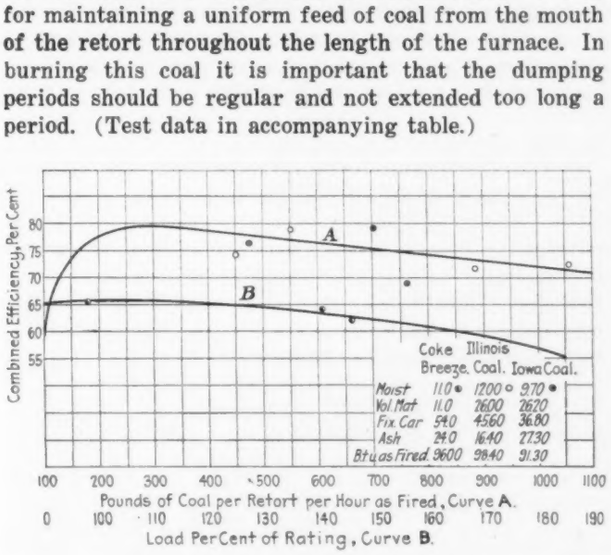

Combined Efficiency, Per Cent
80
75
70
65
60
55
A
B
Coke Breeze.
Illinois Coal.
Iowa Coal.
Moist 11.0 • 12.00 • 9.70 •
Vol. Mat 11.0 26.00 26.20
Fix. Car 54.0 45.60 36.80
Ash 24.0 16.40 27.30
Btu as Fired 9600 9840 9130
100 200 300 400 500 600 700 800 900 1000 1100
Pounds of Coal per Retort per Hour as Fired, Curve A.
0 100 110 120 130 140 150 160 170 180 190
Load Per Cent of Rating, Curve B.

FIG. 4—PERFORMANCE OBTAINED WITH LOW-GRADE FUEL (TAYLOR STOKERS)

United Railways & Light Company, Moline, Ill.—This company is burning Illinois coal of approximately 9500 B.t.u. containing 16 to 20 per cent moisture and about 15 per cent ash. Extremely wide range in the rate of fuel burning is desired, so stokers having relatively large retorts fed by triple plungers are used. These stokers may burn as high as 1500 lb. of coal per retort, the efficiency obtained being approximately the same at normal rate as with the smaller stokers and much higher at the higher rates of burning. On account of the large grate area, this stoker is particularly adapted to burning low-grade fuel.

American Sheet & Tin Plate Company, Scottdale, Pa.—Coke breeze containing 11 per cent moisture, 24 per cent ash and 9600 B.t.u. is being burned in this

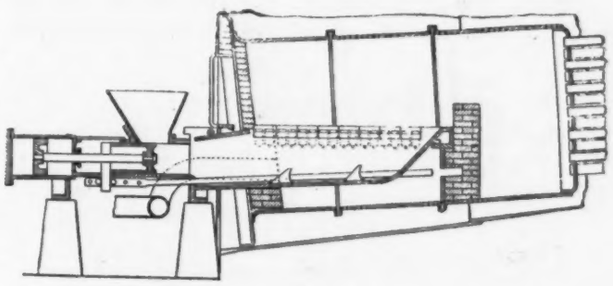


FIG. 5—ANOTHER TYPE OF STOKER ADAPTED TO LOW-GRADE FUEL (UNDERFEED STOKER COMPANY OF AMERICA)

plant, the coke being obtained from beehive ovens. Since the price of this fuel has increased considerably, the tin-plate company has changed to burning ordinary coal. For burning breeze the lower rams of the stokers were replaced by special coke-breeze pushers. The tuyères were also special in that they contained a greater area of air opening than standard types. In addition an arch was employed for hastening the ignition (see table).

Lehigh Coke Company, South Bethlehem, Pa.—In the boiler plant of this company by-product coke breeze which contains 22 per cent moisture, 16 per cent ash and 9552 B.t.u. is being burned successfully. When hand-fired boilers were being employed to burn this fuel only about 70 per cent of boiler rating could be obtained and steam generation had to be discontinued for five to six hours at a time while the fires were being cleaned. With the seven-retort stokers which are now being employed, 120 per cent of boiler rating can be obtained and no time is lost in cleaning. The stoker used is standard except that it is equipped with a lower-ram extension and special tuyères with large air openings. Although the brick work had to be repaired every fifteen or twenty days when hand firing was employed, no brick work repairs have been necessary and there has been no indication that any will be required after six months' operation with underfeed stokers. When this plant is entirely equipped with stokers, it is estimated that the saving in labor expense alone will amount to $45,000 a year.

Sanford Riley Stoker Company.—Many plants using Riley stokers are burning anthracite screenings in cases of necessity. A mixture of 25 per cent soft coal and 75 per cent screenings will give very fair operating results. At times one plant burns straight anthracite screenings, but this practice would not be recommended except in cases of necessity as the underfeed stoker is designed essentially for the distillation and burning of soft coal. In order to increase the life of the side walls in the furnace and to prevent the adherence of clinkers, air from the chamber under the stoker is taken up to a box in the side walls, from which it is discharged into the furnaces just above the grate but

below the top surface of the fuel bed. Exhaust steam may also be admitted at this point.

In some coal there is a great tendency to form clinkers. This may be prevented by having moving retort sides which keep the fuel bed sliced up and homogeneous at all times. If small clinkers form, the movement of the tuyères will prevent their growing in size and will also keep the fuel bed open and porous so that the air for combustion may find a ready exit.

Illinois Stoker Company.—Certain grades of coal tend to form clinkers if agitated during combustion.

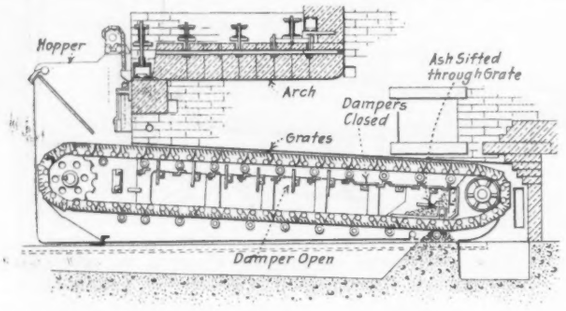


FIG. 6—TRAVELING-GRATE STOKER WITH DAMPERS FOR ADJUSTING AIR PRESSURE UNDER DIFFERENT PORTIONS (ILLINOIS STOKER COMPANY)

To prevent this it is best to use a stoker on which the coal remains undisturbed during the successive steps of burning. The continuous ash-dumping arrangement eliminates the periodic fire cleaning and the attendant loss of load. In order to meet any load conditions that may arise, dampers which are an integral part of the stoker furnished by this company are provided, any one of which may be adjusted independently. With this arrangement the intensity of draft and the quantity of air admitted can be regulated at different parts of the grate. (Test data in accompanying table.)

Underfeed Stoker Company of America.—Unusual success has been obtained in burning bone coal, mine refuse and other fuels that have usually been regarded as practically worthless. At the Spring Valley (Ill.) Coal Company the steam generating plant washed screenings are burned, $5,000 being saved thereby in the first year. Results and tests at this plant indicate an evaporation of 6.02 lb. of water per pound of coal, from and at 212 deg. Fahr. At the Rochester & Pittsburgh Coal & Iron Company's plant in Luzerne, Pa., bone coal which was formerly thrown on the dump is now utilized. After mining the coal, the lump and nut are picked out and the refuse gone over to separate that which is distinctly slack. The remaining product, known as bone coal, is then crushed for use in the furnaces.

Combustion Engineering Corporation.—Type E stokers are being used successfully to burn bituminous, semi-bituminous and sub-bituminous coals with an ash content up to 25 per cent. In the plant of the Pennsylvania Gas Company 150 to 175 per cent boiler rating is being obtained with coal containing 25 per cent ash. Iowa coal containing about 90 per cent moisture and 23 to 32 per cent ash and 7300 to 9000 B.t.u. is burned quite satisfactorily in the generating station of the Fort Dodge, Des Moines & Southern Railway, Boone, Iowa. As a general rule, however, the Coxe traveling grate stoker would be better for coal of this type. This stoker is in successful use at the present time for burning refuse anthracite, such as culm, silt and sizes finer than No. 3 buckwheat. This stoker is also capable of burning coke breeze or refuse from by-product coke plants and beehive ovens, breeze with an ash content of 25 per cent being handled successfully.

The principal trouble with burning low-grade fuel is the formation of clinkers on either the side walls or grates. Forged-steel or rolled-steel water boxes placed along the fire line for at least two-thirds of the stoker length will prevent this trouble when burning coal with an ash content as high as 35 or 40 per cent and with combustion rates as high as 30 to 40 lb. per square foot. While exhaust steam will help rot the clinkers and make them easier to remove, such a large quantity is required that it is not always practicable to employ this method. So much trouble has been experienced with firebrick lately that it is believed that firebrick manufacturers are not able to obtain as good clays as before the war. When temperatures as high as 2800 or 2900 deg. are reached, the best firebrick must be used. Brick which will give entire satisfaction in side walls will not necessarily stand up in arch construction, probably due to the fact that at the temperatures obtained the bricks become plastic and compress from the weight of the arch, or possibly the temperature reached is in excess of the temperature at which the brick was burned and hence there is shrinkage. Brick that is high in silica is usually less plastic than clay brick, but the silica causes the brick to spall with any rapid changes of temperature. The suspended type of arch avoids part of these difficulties.

Laclede-Christy Clay Products Company. — The stokers produced by this company are fitted for all fuel mined west of the Indiana-Ohio line. Among the features which should be incorporated in a furnace, according to this company, are the following: High bridge wall with a vertical front face which reflects its heat directly to the incoming fuel near the feed gate; an inclined stoker which permits this reflected heat from the bridge wall to take effect on the incoming fuel; an agitation combustion arch so arranged that all of the heat from the most intensely heated parts of the furnace is directly reflected on the incoming fuel, and a vertical flame travels from the most effective part of the fuel bed to the combustion chamber. This company has centered its investigations on the design of the combustion chamber, bridge wall, combustion arch and other features of furnace designs.

RESULTS OBTAINED BURNING ILLINOIS BITUMINOUS SLACK AND SOUTHERN KANSAS SLACK RESPECTIVELY ON ILLINOIS CHAIN GRATES

	Illinois Slack	Kansas Slack
Moisture in coal, per cent	13.06	4.18
Ash and refuse in dry coal, per cent	18.7	16.94
Dry coal per square foot of grate surface per hour, lb.	26.44	15.87
Force of draft over fire, inches of water	0.232	0.12
Horsepower developed, per cent of rating	127.8	92.4
Equivalent evaporation from and at 212 deg. per pound coal as fired, lb	7.848	9.11
Calorific value of the dry coal per pound, B.t.u.	11,753	12,565
Efficiency, including grate and based on dry coal, per cent	74.53	74.34

Central Station Power for the Industries

Increased Manufacturing Business Due to War, Importance of Uninterrupted Service and Scarcity of Coal Have Forced Industrial Plants to Adopt Central Station Service—Advantages of Such Service in Normal Times

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SYNOPSIS.—In this article the important question of central station power for the industries is discussed from the viewpoint of the manufacturer as well as that of the central station. From the manufacturer's point of view three phases of the subject are discussed: (a) the limitations to highly efficient power production in the power plant connected with the average factory; (b) relation of fixed charges and load factor to the power cost, and (c) the economic advantages of purchased power because of its greater reliability, because the central station specializes in the manufacture of power, and also because the avoidance of the investment for generating equipment virtually increases the credit of a corporation. The trend in the use of purchased power is discussed briefly with concluding paragraphs on the point of view of the central station to the problem as a whole. The article summarizes the two aspects of the question and hence forms an unusually important discussion both for the manufacturer and for the central station.

TWO viewpoints are suggested by the title of this article—(1) that of the manufacturing plant concerned with the various points in favor of or against the purchase of electric power in comparison with the production of power in its own plant as a part of the industrial equipment; (2) that of the central station concerned with the possibilities from the commercial point of view in the supply of power to industrial establishments as a part of the total output.

It is proposed in the present article to treat more particularly those phases of the question which relate directly to the industries and merely to touch upon the aspects in which the central station is becoming more and more vitally interested. From the first-mentioned point of view three principal items stand out prominently. One relates to the broad question of the limitations to high efficiency in the production of power imposed on the average manufacturing plant by the use of relatively small engines and generators when the power plant is made an adjunct of the establishment. The second involves the distribution of fixed charges for generating equipment over a relatively small kilowatt-hour output with the attending increase in the actual cost of the power. The third includes the various economic advantages to the average factory which usually obtain when power is purchased, thus placing the whole question of the power supply outside of the industry and in the hands of those who make a specialty of power manufacture and distribution.

TREND IN THE USE OF CENTRAL STATION POWER

Before discussing these three phases of the power problem from the standpoint of the industries, reference will be made to the trend in the use of central station power in comparison with the growth of the total power used in such plants.

To illustrate this feature Fig. 1 has been prepared on a basis of available United States Census reports. This chart relates primarily to the use of power in the machinery building trades and thus is limited to one line of manufacture. However, it constitutes such an important branch of industry that it will serve as a representative case.

Of the total electric horsepower a part is developed by the private generating equipment connected with the various factories and a part is purchased. The ordinates of the lower curve stand for the electric part developed by the factories themselves, and the ordinates between the lower curve and the middle curve show the corresponding part of the total electric power which is purchased. Probably the most interesting and important feature of this chart is the fact that the curves

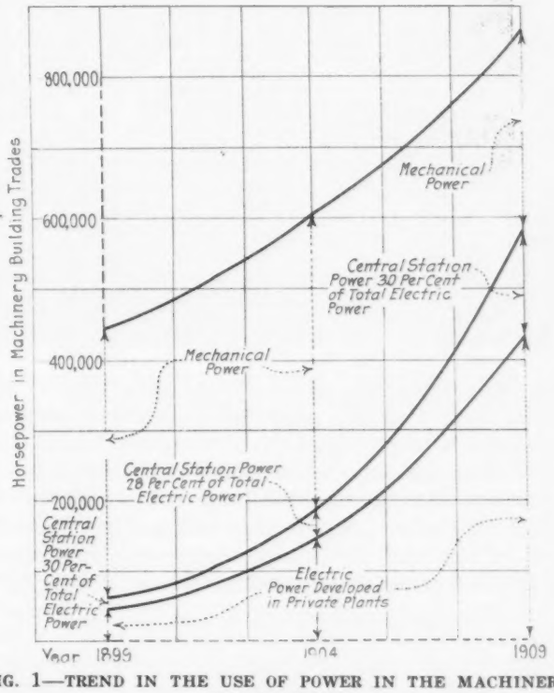


FIG. 1—TREND IN THE USE OF POWER IN THE MACHINERY BUILDING TRADES

show the ratio of purchased to the total electric power to have remained practically constant for the interval of years shown in the chart, notwithstanding the further fact that both the total electric power and the purchased electric power have shown remarkable increases for these ten years.

Conditions since the effects of the European war have been felt in this country are decidedly different from those represented by the census curves, however. In the last three years the central-station load of this country has more than doubled—an achievement that was never dreamed of before. In one case a central station took on 100,000 hp. in load, whereas it never before secured more than 33,000 hp. in a year. Other central station plants were so loaded that they could not take on any more business—all due to the industrial development. Industrial plants have been compelled to

adopt central station power because of the sudden demand for their product, and the rapid growth in business cannot be met by installing or enlarging isolated plants. Furthermore, continuity of service and the scarcity of fuel have made isolated-plant service unattractive and uneconomical.

It is therefore unsafe to draw any conclusions as to the attitude of the manufacturers toward central station power from the census curves other than to point to the wide field still open for the central stations in obtaining a larger share of the business which would be involved not only in the supply of some or all of the power included between the lower curve and the horizontal reference axis but also that part which is still used in mechanical form and represented on this chart by the ordinates between the middle and upper curves

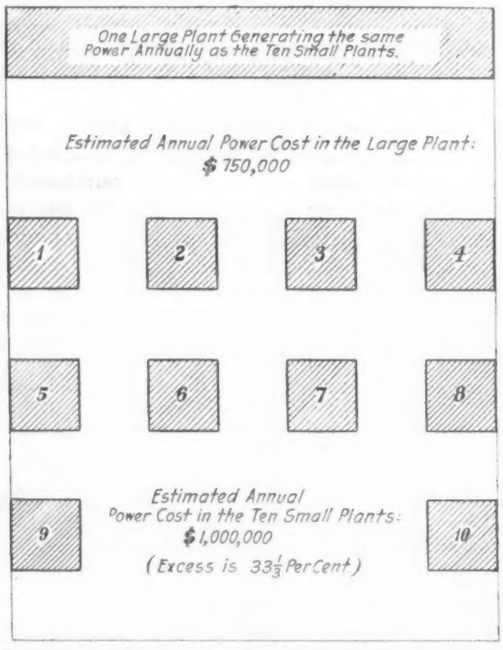


FIG. 2—EXTRA ANNUAL COST REQUIRED WHEN A GIVEN BLOCK OF POWER IS DEVELOPED IN A NUMBER OF SMALL PLANTS RATHER THAN IN ONE LARGE CENTRAL STATION (BASED ON ESTIMATES)

EFFICIENCY IN POWER GENERATION

One of the fundamental differences between the large central station and the generating plant connected with the average factory lies in the size and consequently the economy of the generators and prime movers employed. During the last thirty years remarkable changes have been effected in the sizes of engines, turbines and generators for use in central stations, the earlier equipment with ratings on the order of a few hundred horsepower or kilowatts having been superseded by single units in the larger stations with ratings in the tens of thousands of kilowatts.

As a result the steam consumption in pounds per kilowatt-hour for the large central stations has decreased from about 25 or 27 down to about 11¼ in the interval between 1890 and 1916, while the corresponding figures for the small engines used in manufacturing plants are from about 29 lb. to 59 lb. of steam per kilowatt-hour in 1890 down to 25 lb. to 40 lb. in 1914.[1]

[1]Based on curves by Prof. Chas. F. Scott, *Electric Journal*, Vol XII, No. 1, p. 8.

The sizes of the central stations in this interval have increased in the larger centers to such an extent that units of the larger size and economy can be employed. The generating plant connected with the average factory must, however, of necessity usually remain so small that there has been little or no change in the sizes of individual units employed in such cases.

The larger central stations have thus profited in a twofold manner by the experience of the past years—first, by the improvements which have been made in engines and generators of a given size, and, second, by the inherently greater efficiency with which power can be produced in large rather than small units. The average manufacturing plant, on the other hand, in the production of its own electric power has usually profited only by the slightly greater efficiency of modern engines and generators in comparison with the efficiency of older units of the same size.

The preceding figures show at a glance one of the important reasons why the average manufacturing plant is unable to compete with the large central stations on the basis of actual costs for power production. There are, of course, many other reasons for increased economies in the large stations, of which the above data are only illustrative. As an example of the magnitude of these economies Fig. 2 has been drawn to represent graphically on the basis of careful estimates[2] the extra annual cost required to develop a given block of power in ten small plants rather than in one large central station, the excess in this case amounting to about 33⅓ per cent.

DEPENDENCE OF KILOWATT-HOUR COSTS ON LOAD FACTOR

The fundamental dependence of power costs on the load factor is strikingly illustrated by Fig. 3. The two curves[3] merely emphasize the well-known principle that during periods of business depression a factory with its own small power plant will pay considerably more for its power than at other more prosperous times when the load factor of the plant is higher.

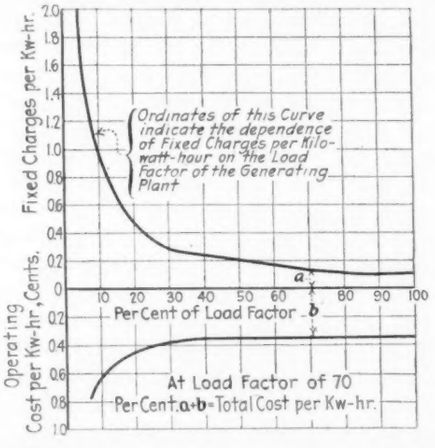


FIG. 3—DEPENDENCE OF FIXED AND OPERATING COSTS ON LOAD FACTOR IN A GIVEN CASE, INDICATING WHY POWER COSTS ARE USUALLY SO HIGH WHEN THE AVERAGE FACTORY HAS ITS OWN SMALL POWER PLANT

This is, of course, partly due to the fixed charges, which largely go on independently of the number of

[2]From a paper by R. F. Hale, *Transactions A. I. E. E.*, Vol XXIX, p. 131.

[3]From a paper by H. G. Stott, *Transactions A. I. E. E.*, Vol XXXII, p. 1646.

hours per day the plant is operated or of the amount of load in terms of the total capacity of the plant, and partly to the fact that certain components of the operation costs, such as the labor item, are largely independent of the load factor and hence form a larger amount per kilowatt-hour output at times of light load than at periods of heavy load.

Hence it may be readily seen that any isolated plant which bases its accounts purely on the coal consumed and on incidental charges connected with operation may arrive at results which are far from accurate unless the actual output for the period considered is known and the fixed charges are added to the operating costs on a basis of this actual output.

There is, however, quite another side to this question aside from the high cost of power per kilowatt-hour in the isolated plant during times of business depression. The normal conditions in prosperous times may be such that the load factor is low, which will mean a relatively high cost of power at all times, with heavier charges in dull times.

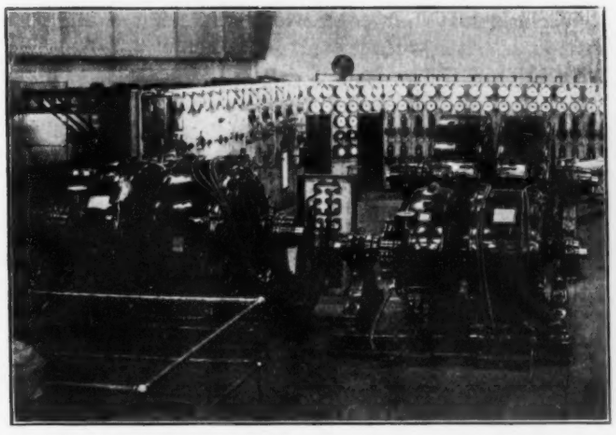


FIG. 4—WITH THE RELATIVELY SMALL UNITS USED IN THE AVERAGE FACTORY THE STEAM CONSUMPTION PER KILOWATT-HOUR IS RELATIVELY HIGH

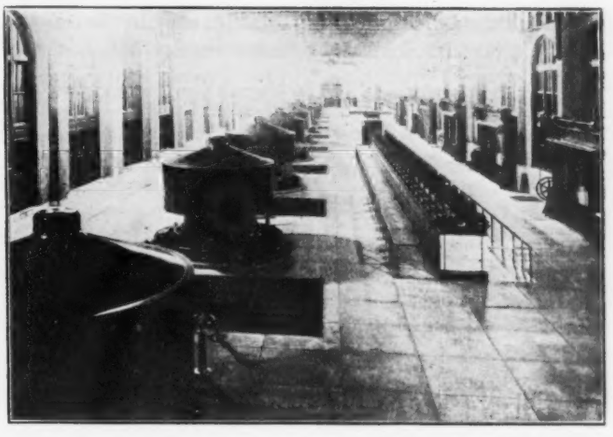


FIG. 5—LARGE UNITS MEAN HIGH EFFICIENCY, AND A HIGH LOAD FACTOR MEANS LOW FIXED CHARGES PER KILOWATT-HOUR OUTPUT

Keeping the facts shown by Fig. 3 in mind, a reference to the table illustrates the unusually low values of load factor which may be experienced in typical industries.[1] It may be gathered from these data, therefore, that even under normal working conditions the cost of the power supply from an isolated plant is likely to be high when all the components of the total cost are properly proportioned over the actual kilowatt-hour output, and obviously the cost will increase considerably at times when the factory is run with production below normal.

ECONOMIC ADVANTAGES IN THE PURCHASE OF POWER

There is a tendency on the part of the advocates of the isolated plant, and also possibly to some extent on the part of the industries, to discount the differences between the costs of generating their own power and of purchasing from a central station, and even where the difference is admitted in favor of the central station, there is sometimes a feeling that the central station rates are prepared in such a manner as to offset the advantages which it possesses in the manufacture of power on a large scale. It is therefore advisable to carry this discussion one step further and to consider briefly the economic advantages of central station power even if the costs were equal or somewhat higher than those of an isolated plant connected with the factory.

It must be remembered in this discussion that the power item in the average factory is usually very small in comparison with the total cost of production (on the order of 5 per cent and less), so that even a large saving in the cost of power is not likely to produce more than a minor saving in the total production cost. However, a failure of the power supply for only a few minutes due to inadequacy in the methods or equipment in the isolated power plant is likely to result in a very large loss because the entire plant is temporarily shut down by such an irregularity, or at least that portion which is dependent on power for the operation of machinery. It can easily happen, therefore, that because of unreliability in its power supply the small isolated plant is the source of far larger losses to the factory than any difference one way or the other which might be found in the total costs of its own power and that from a central station.

This feature of reliability, taken along with that of constancy in voltage under all load conditions so that motor speeds may be maintained up to standard at all times, forms a very marked advantage in favor of purchased power. To this there may be added the fact that to the central station the manufacture of power is the specialized objective. The attention of experts is concentrated on the production of power at a minimum cost and at a maximum of reliability. In the manufacturing organization the lay-out of the plant is based on the manufacture of a definite commodity, and if an isolated power plant is added as a part of the equipment it is necessarily of secondary concern in the minds of those who are in charge of the whole establishment. Of the two cases, it would naturally be presumed that the former would be typical of far more nearly ideal conditions for the realization of economy and reliability in the power production problem than the latter.

Again, it can be shown that a manufacturer, and particularly one who has difficulty in obtaining funds for his organization, should conserve his credit as far as possible in the lay-out of the factory. A. E. Rickards, in a very interesting discussion on the oppor-

[1] The table is based on data of A. E. Rickards, *Electric Journal*, Vol. XI, No. 4, p. 219.

tunities for central stations,[5] shows that under the circumstances of difficulty in securing funds the manufacturer who ties up his capital in power plant equipment uses up his credit in what may be termed the non-productive end of the business, this point being amplified in the form of an example which has been considerably abridged and reduced to tabular form in the following:

CASE I.—
$100,000 (the entire capital) raised by issuing stock.
Estimated result 6 per cent dividend on the stock.

CASE II.—
$50,000 (half the entire capital) raised by 5 per cent bonds.
5,000 borrowed from bank at 5 per cent.
10,000 credit secured from the people from whom supplies are purchased.
35,000 raised by issuing stock.
Estimated result: $3,250 required for the interest on bonds and borrowed funds and 9.2 per cent dividend on the stock issued.

The marked advantage of Case II over Case I in the matter of possible dividends on the stock is apparent, this advantage being due partly of course to the amount of credit possessed by the manufacturer. Mr. Rickards

DATA ON FOUNDRY AND MACHINE SHOP INDUSTRY

Case Number	Maximum Horsepower Demand	Per Cent Load Factor	Cost in Cents per Horsepower-Hour	
			Isolated Plant	Central Station
Foundries:				
1	40	24.0	2.50	1.58
2	40	6.8	4.69	2.37
3	50	13.7	4.09	1.91
4	70	30.7	1.80	1.61
5	85	16.0	3.40	1.80
6	300	14.0	2.40	1.69
7	400	23.0	1.20	1.40
Machine shops:				
8	35	19.0	2.20	1.59
9	40	16.0	3.40	1.76
10	50	19.0	3.30	1.89
11	50	19.0	3.90	1.89
12	50	8.5	5.60	2.46
13	100	31.0	2.78	1.60
14	125	56.0	1.30	1.30
15	125	20.0	2.90	1.76
16	125	16.0	2.90	1.77
17	130	13.0	3.50	2.17
18	130	19.0	2.90	1.70
19	200	6.0	4.70	2.18
20	300	16.0	2.40	1.61
21	480	17.0	2.90	2.56
22	1600	14.0	2.00	1.73

points out in this connection that the average corporation can usually borrow from 70 to 80 per cent of its "quick" assets, whereas on buildings and machinery seldom more than 25 per cent of the appraised value can be borrowed. From this it follows that the manufacturer who invests in an isolated power plant is unduly using up his credit, and hence purchased power contributes in such a case to increase (virtually) his credit, as an additional item over and above the economic advantages as previously outlined.

The Central Station Point of View

This second phase of the question has been so thoroughly discussed in various papers on the subject that it is the purpose here merely to touch briefly on several of the conclusions which may be reached on a basis of some of this available information. It has been pointed out[6] that while the central station would prefer to have no restrictions on any of its customers, an absence of such limitations would tend to impair the quality of the service not only for the manufacturer who has (or may have) relatively undesirable apparatus but likewise for all others on the same circuit. This fundamental requirement of high quality in central station service quite naturally imposes certain restrictions on the sale of power to larger and smaller manufacturing plants.

It is hardly necessary or advisable in an article of this kind to go into the details of the factors which govern these restrictions other than to say that they involve from the standpoint of the central station such items as the starting current and starting conditions, the power factor of the load, the size of units, the starting devices employed, the types and voltages of the motors to be used, and the hours of service. While the enumeration of these items gives a general idea of the nature of the problem, it is of course obvious that each of these items in itself constitutes a subject which calls for careful and extended study in actual practice.

While it may not be entirely clear that the central station is vitally concerned on a comprehensive scale with the motor application field, the impression on the part of central station companies seems to be that ultimately all motor applications will be related closely to the central station activity. Furthermore, it may be stated that the opinion has been advanced that alternating-current distribution is the ultimate for this service, in spite of the fact that at present there are still many objections to alternating-current motors for certain classes of machinery drives.

Steady Motion-Picture Carbons

In motion-picture lamps it has been customary to have the negative carbon somewhat smaller than the positive upper in order to have the consumption of the electrodes approximately equal and secure a stationary focal point. When, however, the electrodes are made in correct proportion to obtain equal burning, the negative is of sufficient size to cause the arc to wander.

Ben Perris of Lakewood, Ohio, shows in patent No. 1,241,740 how not only can the requirement for equal burning be produced with electrodes having a relative cross section of four to one, but, what is more important, by an improvement in the copper plating of the negative carbon electrode all flickering and spattering of copper upon the condenser lenses can be entirely done away with.

It is well known that if a single heavy copper coating is employed the sheath near the negative tip melts and collects in beads on the end. These molten beads have the peculiar property of spattering and flashing suddenly when the arc touches them. This causes the undesirable flicker and projects molten metal onto the glass lens, where it sticks quite firmly. The copper particles must, of course, be removed from the lens; otherwise the transparency will be affected, and this is more or less difficult to do. The formation of molten beads on the negative tip may be entirely eliminated by covering the copper sheath with a second coating of nickel.

[5] In an article entitled "New Opportunities for Central Stations," *Electric Journal*, Vol. XII, No. 1, p. 10.

[6] Valuable discussions on this phase of the central station field are found in a paper by D. B. Rushmore, *Transactions A. I. E. E.*, Vol. XXXIV, p. 695. References are here made to the discussion of R. F. Schuchardt, R. M. Wilson and Harold Goodwin, Jr.

Factors Affecting Selection of Insulators*

Liability to Interruption Dependent on Size of System—Steel Structures Impose Greater Strains on Insulators than Wood—Nature of Load an Important Consideration

BY A. O. AUSTIN
Chief Engineer Ohio Insulator Company

WHILE it is apparent that the state of the art as regards the design and manufacture of insulators has made remarkable progress in the last few years, it should also be evident to any one making a careful study of line operation that conditions affecting the insulator have not been improved but on the other hand have become more severe. With the growth of a system and the consequent increase in hazard for oil switches, transformers or other apparatus, certain types have been discarded, although they may have given very satisfactory operation at the same voltage when the system was smaller. It is seldom, however, that the growth or size of the system receives consideration when it comes to the performance of the insulator or line, where it may be even more important.

The decrease in reliability is so important in many cases that it has necessitated large expenditures in steam auxiliaries, parallel circuits or reconstruction of the line. In other cases reinsulation of the line has been resorted to in order that better service might be established. However, the factors which affect the performance of the insulator or the reliability of a given line are often far more important in producing

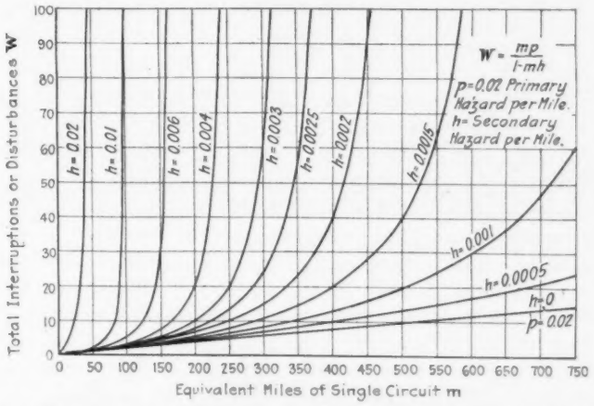


FIG. 1—RELATION BETWEEN TOTAL INTERRUPTIONS AND SIZE OF SYSTEM WITH DIFFERENT SECONDARY HAZARDS

reliability than additional circuits, the reinsulation or the use of a larger size insulator on the system, and should be given careful attention in the construction of a new system or in the operation of an old one.

The lack of knowledge as to line conditions and the exact nature of insulator failures has led to the use of insulator specifications which were based more or less upon arbitrary standards, and it is not surprising that the characteristics in the insulator which are the most important to its successful performance or life for the greater part are not covered by present-day specifications, no matter how rigid. As knowledge of operating conditions and their effect upon the insulator increases engineers will be able to make specifications which cover the essential points and the efforts as applied to the insulator will be far more effective.

It stands to reason that before the knowledge of electrostatics of mechanics can be used to best advantage in designing insulators, it is necessary to determine the line conditions to a considerable extent. The resulting design will then be successful in so far as these conditions have been properly gaged and engineering knowledge has been applied in effecting a good compromise in the design. Although insulators can be built to meet successfully any essential line conditions for a period of years, they at best work upon a narrow margin of safety for some of the stresses to which they are subjected, so it is highly important that the various factors affecting them be considered, as well as their design and manufacture, if the best service is to be obtained from transmission lines.

In any class of engineering work the relation between cost and the result is of prime importance; therefore, if the value of reliability to the system can be determined some basis for the expenditure in the transmission line will be had. The value of reliability is largely determined by the three conditions which follow: (1) Investment depending upon the line; (2) nature of the load; (3) competition.

In considering the investment, it is advisable to remember that the relative cost of the insulator as compared to the remainder of the system is often under 3 or 4 per cent, and that there are only a few systems which could not afford to use more insulation, simply as a matter of good business investment in safeguarding their plants.

As the investment dependent upon the transmission line increases greater expense will be warranted in the transmission line, and it is usually the best policy to use steel construction with ample insulation for the largest lines. It must be remembered, however, that a large expenditure in the line does not necessarily mean reliability, for if steel towers or structures are used in place of wood, the insulator must be very much larger to give the same reliability.

Unless the insulator is sufficiently large, a large investment might readily warrant the use of a wood-pole line to gain greater reliability, as the greater reliability would more than offset the increased depreciation of the wood over steel construction.

NATURE OF THE LOAD AN IMPORTANT CONSIDERATION

The nature of the load, irrespective of the amount of power delivered, often demands the greatest reliability of service, and may be a more important factor in determining the reliability than even the largest investment. Many schemes have been used to increase the reliability of service, such as auxiliary stations and parallel or loop circuits, all of which entail considerable

*This subject was more completely discussed before the Toronto Section of the A. I. E. E.

investments. It is well to remember, however, that the reliability of the insulator has been increased to the point where only a momentary interruption, due to spill-over, need be expected, as the best insulators are practically puncture-proof.

Where the service is such that interruptions due to "kick-outs" on the line, although of momentary dura-

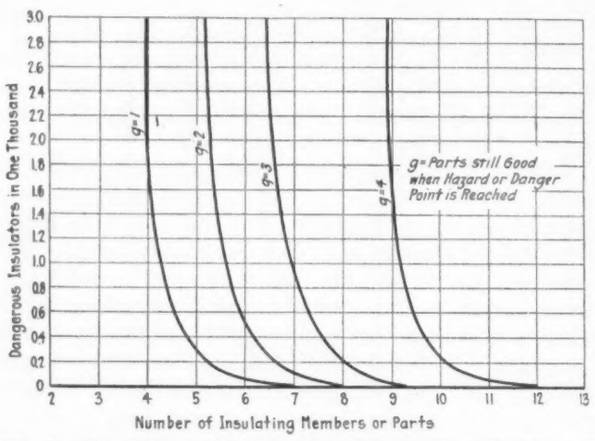


FIG. 2—OPERATING HAZARD WITH DIFFERENT NUMBERS OF PARTS IN INSULATORS DEFECTIVE

tion, cause considerable loss, it is well to bear in mind that even "kick-outs" from lightning can be practically eliminated by using a large insulator on a steel structure or by making the most of a wooden structure equipped with a properly designed insulator about half the size.

Where it is desired to remove even temporary "kick-outs" on the system, this can be accomplished to best advantage by providing one well-insulated circuit rather than parallel circuits of poorer insulation, which is fortunate, as the investment in the first is very much less. A slight increase† in the insulation of a single circuit will increase its reliability so that the insulator hazard may be a negligible quantity.

Analysis of Factors Affecting Line

There are several ways of analyzing the different factors affecting the line, but these will be taken up as general factors affecting the reliability of the line and the insulator, and will be discussed under the following headings: (1) Size of system, (2) construction, (3) method of operation, (4) local conditions, and (5) electrical characteristics of apparatus or line.

By size of the system is meant the miles of system operating from one bus or so connected that a disturbance on one part is felt in the others. A system having small conductors and distributed generating capacity, such that a short-circuit affects only a small portion of the system, hardly comes under the following analysis.

It frequently happens that as a system grows serious trouble seems to start with the addition of a new circuit. Transient phenomena are usually blamed for the trouble, and while this class of disturbance may be a factor in the trouble, it seems that there is reason to believe that there must be other important factors. The fact that some systems operate successfully for a long time without any change in the network, only to have serious trouble which was eliminated upon opening a tie-in line, would indicate that there are other factors.

†Discussed in paper before the Canadian Society at Montreal and the American Institute of Electrical Engineers in December, 1914.

Another fact which tends to strengthen this view is that there are many instances where the operators on two systems which have been tied together blame each other for abnormal amounts of trouble which did not occur before combined operation.

For purpose of analysis, trouble has been divided into two classes, primary and secondary. The principal items under primary trouble are: short-circuits produced by lightning; ground wire coming in contact with power wire; mechanical short circuits or other disturbances set up by customers, and insulators that fail under normal line voltage or during a switching operation, or the charging of an arrester with too low a resistance or that following the failure of apparatus. Secondary trouble may include breakdowns of insulators or apparatus due to primary disturbances or switching surges due to cutting out or in the line following a primary disturbance or the failure of apparatus due to primary trouble.

While the operating log of many systems will furnish data as to the primary and secondary interruptions, no application has been made showing the rather startling effect produced by the primary and secondary hazard as the connected mileage increases, so this subject will be discussed next.

Primary failures or disturbances may be regarded as increasing directly as the connected mileage. Thus it follows that $a = mp$ (1) where a = number of primary disturbances or interruptions in a given time T; m = miles of single circuit or number of insulators, and p = primary hazard or probable number of failures per mile of circuit in time T. The secondary disturbances depend upon other disturbances, and if the probability of one disturbance in producing another is equal to r, the total amount of trouble produced by an interruption or disturbance in terms of r can be found.

Secondary interruptions produce disturbances similar to the primary, so they in turn tend to produce other failures until the effect of the disturbance dies out. For the secondary hazard

$q = (1r) + (1r)r + [(1r)r]r = r + r^2 + r^3$, etc. (2)

If q equals the total secondary trouble produced by one case of primary trouble, it follows that the total secondary trouble U may be obtained by multiplying this

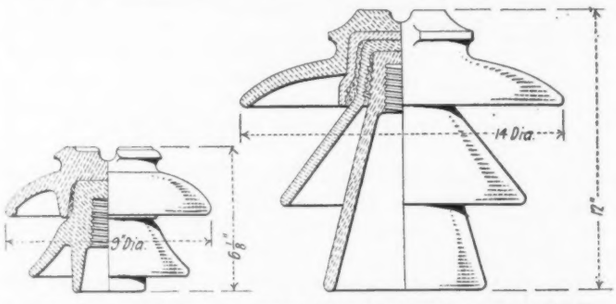


FIG. 3—TWO TYPES OF INSULATORS COMPARED IN TABLE II

quantity by the number of primary interruptions or disturbances for a given time T, hence $U = aq$.

The total line disturbances or interruptions W will be the sum of the primary and secondary disturbances, or $W = a + U = a + aq$. Substituting from (2) $W = a + a(r + r^2 + r^3 \ldots) = a + ar + ar^2 + ar^3 \ldots ar^{n-1}$. This, however, is a receding geometric series where r is less than 1, which it must be for practical

operation, otherwise there would be no stopping trouble once it started. The sum of the progression equals $W = a(r^n - 1)/(r - 1)$, or $a/(1 - r) - ar^n/(1 - r)$. Since r is less than 1, making n large reduces $ar^n/(1 - r)$ to a negligible quantity; hence, for practical purposes $W = a/(1 - r)$. (3)

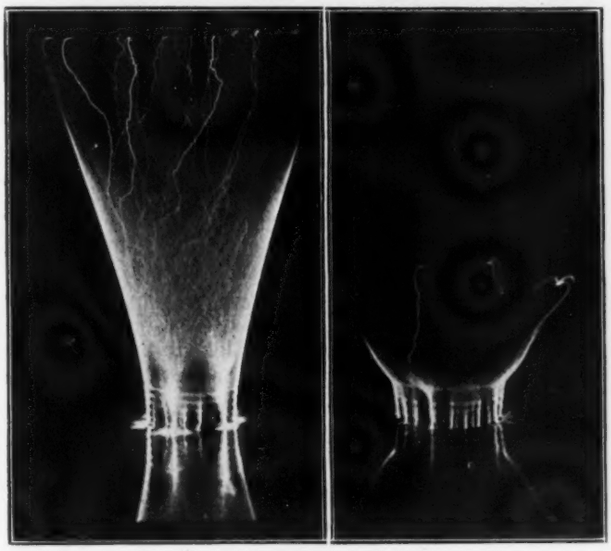
As the effect of mileage on (a) in (3) is known, it is to be seen if it has any effect upon r before the equation can be used to advantage in studying the effect of connected mileage upon the reliability of the system. Since r represents the probability of one interruption or disturbance starting another, for the system as a whole, it follows that r will vary directly as the number of insulators or miles affected m and with the probability of secondary failure h per mile. Hence

$$r = mh, \quad (4)$$

or substituting values in (3) from (1) and (4)

$$W = mp/(1 - mh). \quad (5)$$

This equation is of great practical value in determining whether it is advisable to increase or decrease the connected mileage m for the system, as the probable



FIGS. 4 AND 5—SMALL AND LARGE INSULATOR SECTIONS BEING SUBJECTED TO SAME VOLTAGE

amount of line trouble for different lengths of line can usually be computed from data obtained from the usual records. The records on most systems will give the total number of disturbances W, the primary disturbances a and the connected mileage m. It then remains to apply these to equation (5).

From (1) $a = mp$, and since a and m are known, $p = a/m$. The only unknown quantity in the formula (5) is h; solving for this quantity

$$h = (W - mp)/mW. \quad (6)$$

Since W, m and a or mp can be obtained from the records, h may be determined and formula (5) used to study the effect of changes in the connected mileage.

The following example will show how readily this equation may be applied. A system having 200 miles (321.9 km.) connected circuit has a total of ten interruptions or disturbances in a given time, four of which are primary. The 200 miles (321.9 km.) of circuit is composed of two 100-mile (160.9-km.) circuits operating from the same bus. The service is important and it is desired to determine the relative service where the present system is split into two 100-mile (160.9-km.) circuits and where a 100-mile (160.9-km.) circuit is added to the present, making the connected mileage 300 (482.8 km.).

From the foregoing $W = 10$, $a = 4$, $m = 200$, therefore according to equation (1) $p = 0.02$ and from (6) $h = 0.003$.

For the divided system $m = 100$, $p = 0.02$, and $h = 0.003$, thus substituting in (5) $W = 2.86$.

For the system operated as a unit with the 100 miles (160.9 km.) additional circuit added $m = 300$, $p = 0.02$, and $h = 0.003$, thus substituting in (5) $W = 60$.

The advantage gained in improved service by splitting up the system can be seen from Table I. The probable increase in interruptions from ten for 200 miles (321.9 km.) of circuit to sixty for 300 miles (482.8 km.) of connected circuit shows why some systems tend to strike an epidemic of trouble when they add more mileage by connecting additional circuits or by tying into another system.

TABLE I—ADVANTAGES FROM SPLITTING UP SYSTEM

	Connected Mileage		
	100	200	300
Probable disturbances in given time T	2.86	10	60
Probable trouble compared to 200-mile system (per cent)	28.6	100	600
Probable trouble compared to 100-mile system (per cent)	100	350	2100

The effect of mileage on the above system is shown in Fig. 1 in the curve where $h = 0.003$.

That these values are not due to high or unreasonable values is readily seen, for $p = 0.02$, which means that there are only two primary disturbances for 100 miles (160.9 km.) of circuit, and this is very low for all except the best insulated or constructed systems. The value of $h = 0.003$ is also low for all except new highly insulated systems, for this is equivalent to $100 \times 0.003 = 0.3$ probable failures per disturbance on 100 miles (160.9 km.) of circuit. Where $h = 0.003$, an average of $1 \div 0.3 = 3\frac{1}{3}$ cases of trouble are necessary to cause another failure. There are many lines which start with much lower secondary hazard than this, but soon have a much higher hazard through insulator depreciation. This subject can best be discussed under operation.

The curves in Fig. 1 show the probable number of disturbances or interruptions for several values of secondary hazard (h) and for a primary hazard p of 0.02. The curves show that as the secondary hazard increases the connected mileage which it is practicable to operate becomes decidedly less.

The secondary hazard tends to increase with time, and it is well to bear in mind that a new system may start with no secondary hazard ($h = 0$) so far as the insulators are concerned. Later on, however, the secondary hazard may have increased to $h = 0.001$, in which case a 500-mile (804.7-km.) system would have twenty instead of ten interruptions or the mileage would have to be reduced to 330 to give the same service. If in time the secondary hazard should increase to 0.002 the curve $h = 0.002$ shows that the operation of the 500-mile (804.7-km.) system becomes hopeless. It is further evident, however, that splitting the system into two 250-mile (402.3-km.) sections establishes the same standard of service as at the start.

A consideration of equation $W = mp/(1 - mh)$ is

then a strong argument for keeping down the connected mileage. The inconvenience of splitting up the bus to operate different or parallel circuits independently where the primary hazard p is high or where the secondary hazard has increased will usually pay well for a lowered efficiency as to generating equipment.

If a better operating line is not deemed sufficient to warrant lowering the efficiency of generating apparatus, it must be borne in mind that splitting up the system greatly reduces the hazard to apparatus from short-circuits. Where the system is large the hazard to apparatus cannot be considered lightly, for it amounts to a considerable maintenance charge even on the best apparatus that can be produced. The smaller system will also permit of cheaper apparatus or lower investment on the line for the same standard of service. This reduction in investment will also be aided by a lower operating and maintenance expense, which should be given careful consideration in the laying out of a new system or where maintenance and service are important on an old one.

In Fig. 2 several curves are shown which give the operating hazard with various numbers of parts or sections in the insulator under assumed conditions as regards depreciation and minimum line voltage that will cause trouble. These curves show that there is a very marked decrease in the operating hazard or probability of trouble with a comparatively slight increase in the size of the insulator.

Where a steel structure is used the insulator has to withstand the entire stress, and it has been found that insulators which gave good service on wood structures gave no end of trouble when used for the same voltage on steel structures. This increased trouble was caused chiefly by punctured insulators or by shorts produced by birds. Improved designs and manufactures have made the elimination of the former possible, but the latter is still a matter that deserves very careful consideration, even though the insulators do not puncture.

TABLE II—COMPARISON OF ELECTRICAL PROPERTIES OF INSULATORS SHOWN IN FIG. 3

	Type	
	A	B
Test on part (kv.)	80	50, 40, 60
Total test on parts (kv.)	160	150
Assembled test (kv.)	125	120
Dry flashover (kv.)	135	185
Striking distance (in.)	8	14
Test per inch of striking distance (kv.)	20	10.7

An analysis of the modern insulator will show that the hazard due to puncture need not be considered even on a steel structure, at least for a long time.

The comparison of one of the modern insulators with those of a few years ago readily shows how this may be possible. In Fig. 3 are shown a 33-kv. insulator and a 65-kv. insulator of a few years ago. Table II compares their respective electrical properties.

That the small insulator is not deficient in insulation is shown in Fig. 4. The large part in Fig. 4 is much larger than the center in *B*, Fig. 3, while the small part in multiple is the center of *A*, Fig. 3. It will be noticed that the larger part has a lower flashover than the smaller, showing conclusively that the latter is not deficient as to tested strength.

Since the large insulators of a few years ago gave fair service for some time when mounted on a steel structure, it will be seen that the modern insulator with a tested strength of nearly double the value for the protecting air path around the insulator can certainly be depended upon. The small insulator in Fig. 3 has a very low charging current; hence it may be used on a wood structure where the larger would cause digestion or burning.

Although the modern insulator may be made puncture-proof care must be exercised in its use, for there are a number of other troubles on the line which must be guarded against. If the small insulator is mounted on a steel structure or a grounded metal arm, a bird may come too near the tie wire and cause a short circuit. Lightning will also cause the insulator to flash over and produce a short circuit if mounted on the steel structure. On the other hand, if the insulator is mounted on a good wooden structure, the resistance to ground will prevent a power arc "picking up" when a bird comes near the insulator, and as the pole has a low flux-carrying capacity, it carries a considerable voltage during a surge and may prevent the insulator from flashing over.

The remainder of this article will be contained in a subsequent issue of the ELECTRICAL WORLD.

ELECTRIC SERVICE AT CAMP HANCOCK

Augusta-Aiken Railway & Electric Corporation Furnishes Energy for the Large Cantonment in Georgia

BY N. NESBITT TEAGUE

Augusta-Aiken Railway & Electric Corporation, Augusta, Ga.

The electric service for Camp Hancock, Augusta, Ga., is furnished by the Augusta-Aiken Railway & Electric Corporation. The primary service that Camp Hancock will give will be as a mobilization and training camp for the Pennsylvania National Guard. This camp is on a rolling terrain 400 ft. (121.9 m.) above sea level overlooking Augusta.

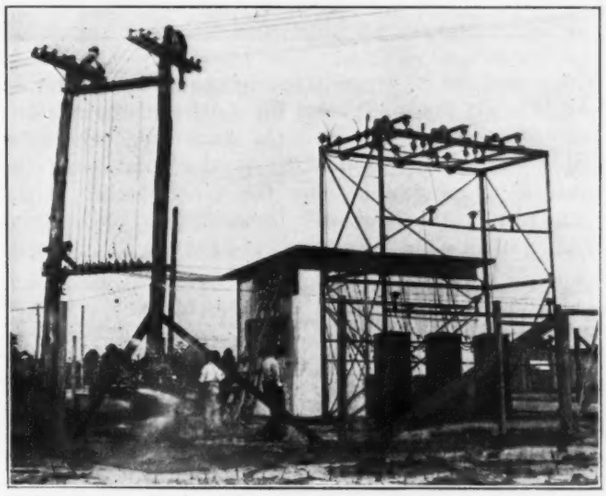
Part of the site was used by the same troops in 1898. The present camp covers 2000 acres (809.4 hectares). The government does not buy this property but leases it for two years for $1 through local citizens, who subscribed a fund to buy the crops and property rights of the owners.

This camp is a tented camp and not a cantonment; nevertheless there will be when completed 887 buildings used as storehouses, mess shacks, etc. The construction of the wood buildings is such that the camp may be converted easily into a cantonment later if desired. The plans for occupancy of this site are made for at least a two-year stay.

The artillery range will be near Grovetown, Ga., about 15 miles (24 km.) from Augusta and 12 miles (19.3 km.) from the camp. It will cover 10,000 to 12,000 acres (4046.8 to 4856.2 hectares).

In addition to the camp there will be near this site a remount station and a base hospital. The remount station will be about 6 miles (9.7 km.) west of the

camp, and will require about 100 acres (40.5 hectares). Here 5000 to 10,000 horses will be trained. Two companies of infantry will be stationed here and several hundred men will be employed for the care of the horses. The base hospital will adjoin the camp and will cover 100 acres (40.5 hectares); fifty-eight buildings will be erected and the construction will require 3,500,000 ft. (1,066,802 m.) of lumber, and as a construction job will be about one-third as large as the camp proper. The hospital when completed will have a capacity of 2000 patients according to present plans.



SUBSTATION IN COURSE OF CONSTRUCTION

The camp is only a few hundred yards from the city water works. The city has laid a 16-in. (40.6-cm.) water main to the camp where it has been connected with several miles of newly laid water piping. For the additional requirements it has been necessary to install two additional pumps. These two 8-in. (20.3-cm.) Worthington pumps are electrically driven by two 75-hp., 2300-volt motors. The service is the same as that serving the other electric pumps at these waterworks. Two separate two-phase, 2300-volt lines are available, thus insuring continuity of service.

Local men, T. O. Brown & Son, have the contract for the general construction on a cost plus percentage basis, under Major Spreckles, United States quartermaster. The electrical work within the camp is being done by a sub-contractor, the Whitney-McNeil Company, the local central station company having nothing to do with the construction of the overhead lines beyond the substation, which is on the boundary of the camp site.

Some idea of the electrical work may be had when it is understood that when finished there will be used 620 25-ft. to 35-ft. (7.6-m. to 10.7-m.) poles, which will carry in part of the 1,288,000 ft. (393,500 m.) of copper and copper-clad wire of sizes Nos. 14, 10, 8, 6, 4 and 2. Standard pole construction is being carried out with six-pin cross-arms.

It is understood that 17½ cents per hour is being paid to laborers on general camp construction and time and a half for overtime, overtime starting at the end of eight hours. Carpenters are being paid 45 cents per hour with time and a half for overtime. The men work at the camp for ten hours per day.

In the railway substation, built to meet the demands made by heavy travel to the camp, the equipment consists of two six-phase, 60-cycle rotaries, six 110-kva., 13,200/430-volt air-cooled transformers, two alternating-current and two direct-current control panels (all General Electric Company), and starting resistances, blower, reactances and equipment. This building was erected in three days, and the foundations and appurtenances were ready for the machines, which were running forty-eight hours after arrival at the station.

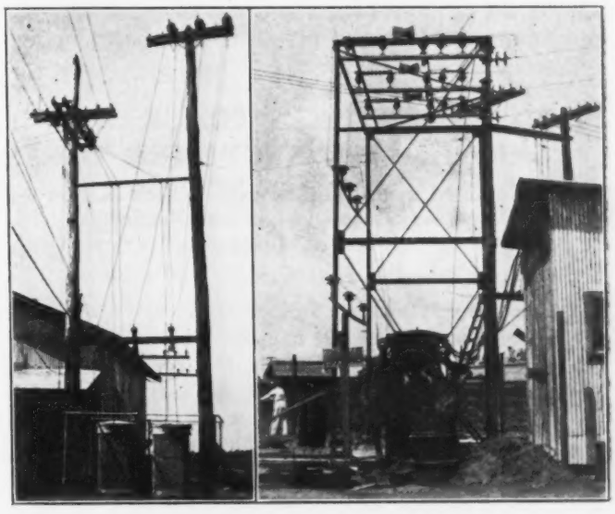
The outdoor substation is served by the same 13,200-volt distribution line and transforms enery from three-two-phase, 13,200/2300 volts, for use at the waterworks. As a duplicate line, to insure continuity of service—for 60,000 people in the city and 30,000 at the camp depend on this system for water—there is installed on the left-hand pole a separate two-phase, 2300-volt distribution line with the necessary double-throw switches so that if either of the two lines are cut off for any reason the operator at the waterworks may, by pulling the rope mechanism at the left-hand pole, throw the double-throw, pole-type oil switches and be ready to continue pumping without delay.

The transformers are mounted on two old rails on the ground, and are fused by means of the three G. E. type D17 switches and expulsion fuses. The indoor and outdoor stations are both using Johnson line clamps as "disconnects," so that either may be cut off.

The army camp is situated about 1000 ft. (304.8 m.) from the railway substation, and this required a very short 13,200-volt, three-phase, 60-cycle line. The central station furnished poles and wires up to this substation. All work on the substation past the high-voltage side was done by the contractors for the camp.

As shown herewith, a steel-frame outdoor substation was used designed by the engineers of the central station. In the house near the outdoor substation is a three-panel, 2300-volt, three-phase distribution board. The three transformers are each rated at 200 kva., 60-cycle, three-phase, 13,200/2300 volts.

At this station, operated by enlisted men of the quartermaster's corps, operators are stationed continually. On the electric construction there were employed from 400 to 500 men. Good material was used and the whole work represents a permanent construction. There will be about 14,000 40-watt lamps in tents and buildings and 125 100-cp., 6.6-amp. street lamps.



RAILWAY AND CAMP SUBSTATION

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

VALUE OF CHECKING MOTOR CURRENT OCCASIONALLY

Load on Floor Above Motor-Driven Shaft Moves Hangers Out of Alignment and Increases Load on Motor

BY E. C. PARHAM

When a motor is used to drive the same machinery year in and year out it is advisable to check the current occasionally, as abnormal conditions are often detected in this way. For instance, a paint manufacturer once complained that a 50-hp., three-phase induction motor would not "stand up under a load" that it was accustomed to carry without distress. On inspection it was found that the motor was smoking, so the current was measured. It was found to be 100 per cent above rating but balanced between the phases, so the trouble was searched for outside the motor. As a preliminary step all of the shaft hangers were cleared of a month's accumulation of mud composed of paint, dust and oil, cleansed with kerosene and lubricated with fresh oil. The same treatment was given to the bearings of all connected machines. The motor was so well housed that it required little attention, but the efficient protection from dust did not help the motor to run cool.

The cleaning reduced the load by about 8 amp. and gave the hangers sufficient outline to permit seeing that they were working around the shaft like eccentrics. Their movement was found to be due to faulty alignment caused by the sagging of the floor above, on which barrels of paint had been stored. On removing this weight the motor current fell nearly to rated value.

GOOD WAY TO KEEP TRACK OF SERIES-ARC RECTIFIER TUBES

A Simple Card and File Method Which Keeps All Necessary Information and Records Is Explained

BY T. E. MADDEX

The accompanying forms illustrate a card system for keeping the service records of series-arc mercury rectifier tubes. Two forms of cards are used. The large card shown in Fig. 2 is filed at the station at which the tube is installed, while the small card, shown in Fig. 1, is filed at the general office.

Referring to Fig. 1, the spaces marked (1) and (2) are filled in as soon as a memorandum is received from the storekeeper showing that the shipment of tubes has been received at the storeroom in good order. Then this card is filed behind the guide "Storeroom Receipts." The tube is next sent to the generating station and tried out on a short-circuit test. If it stands this test, it is put in the station supply rack, or if defective, is returned to the storeroom. In either case the operator takes a blank card of the form in Fig. 2 and fills in properly the spaces marked (1), (2) and (3). If the tube passes the short-circuit test satisfactorily, the card is filed, in the station file, behind the guide "Tubes in Supplies." At the same time the manufacturers' tag bearing the tube number is detached from the tube and forwarded to the general office. In case the tube does not pass the short-circuit test the large card is sent with the manufacturers' tag.

Tube No. (1) *Storeroom Receipt* (2) Date
In Supplies, (3) date and Station
In Supplies, (4) ditto
In Service (5) date *at* Station
Displaced (6) date *Cause*

MONTH	HOURS	TOTAL HOURS	MONTH	HOURS	TOTAL HOURS

FIG. 1—CARD FILED AT GENERAL OFFICE GIVING ARC RECTIFIER DATA

In either case this procedure constitutes a notification that the tube has been received at the station and has had the short-circuit test, and it also indicates the result of the test. Upon receiving this notification the clerk at the general office takes the small card bearing the same tube number from his file, fills in the space (3) and notes the name of station at which the tube is installed, after which the card is filed behind the guide "Tubes in Supplies" under the name of the station. The space on this card marked (4) is provided in case a tube shall be transferred from one station to another.

Mercury Arc Rectifier Tube No. (1) 42.2
Received in Supplies (2) date and station
Tried on Short (3) date *Result*
Put in Service (4) date *Remarks*
Displaced (5) date *Cause*
Total Hours (6) date

DAILY SERVICE RECORD

CKT.	DATE	HRS.	MIN.	TOTAL HRS.	TOTAL MIN.	CKT.	DATE	HRS.	MIN.	TOTAL HRS.	TOTAL MIN.	MEMO.

TEAR OFF ALONG THIS LINE.

NOTE.—THIS COUPON TO BE DETACHED AND RETURNED TO [redacted], CARE GEN. OFFICE AS SOON AS THE TUBE IS PUT IN SERVICE.

Tube No. ... *has been put in service.*
Date ... *Station* ... *Ckt.* ...
Remarks ...

FIG. 2—ARC RECTIFIER RECORD FILED WHERE APPARATUS IS USED; INSERT IS ATTACHED TO LEFT END OF CARD

When a tube is put in service the operator selects the large card bearing that tube number, fills in the spaces of the coupon attached to the left end, also the space marked (4) of this card. The coupon is then detached and forwarded to the general office, and the large card is filed behind guide "Tubes in Service." Upon receipt of this coupon the clerk at the general office

selects the proper small card from his file, fills in the space (5), then files it behind the guide "Tubes in Service" under the proper station guide.

Eventually the tube breaks or is otherwise incapacitated for further service and is permanently displaced. At this time the operator selects from his file the large card representing this tube, fills in the spaces (5) and (6) and mails the card to the general office. From this large card the clerk completes the record on the corresponding small card and then files the small card permanently behind the guide "Tubes Displaced" under the proper station.

On the large card space is provided for the daily service record of hours, as well as space to which the daily totals are extended. This record is continued on the reverse of the card. Every month the total hours are checked and entered in the spaces provided for this on the small cards. In filing the large cards the operator places a clip over the number along the top edge of the card to correspond to the circuit on which the tube is operated as an aid in locating the cards in reference to the circuits. In the operators' file there is provided a guide "Tubes Resting," to take care of the cards for tubes which are temporarily out of service.

Before this system was inaugurated the tube records were kept by the operators in a book and, besides being more or less unintelligible, were very cumbersome and caused a great deal of trouble on account of lost tubes. With the card system the office file contains all the information usually required and is automatically kept up to date.

COMPARATIVE LABOR NEEDS OF ENGINES AND TURBINE

Eighteen More Oilers Are Required for Six 1500-Kw. Engines than Have Been Found Necessary for One 15,000-Kw. Turbine

The comparative economy of engine-driven and turbine-operated plants was emphasized in the recent argument of the Boston Edison street-lighting rate case before the Massachusetts Gas and Electric Light Commission. It was pointed out that the engine plant at the L station, South Boston, which is normally held in reserve, consists of six vertical cross-compound units driving 1500-kw. generators and vertical turbine sets rated at 12,000 kw. and 15,000 kw. It required 17 lb. to 18 lb. (7.7 kg. to 8.2 kg.) of steam per kilowatt-hour to operate the engine station, compared with 13 lb. to 14 lb. (5.9 kg. to 6.4 kg.) for the turbine section.

The difference in labor requirements is still more striking. To operate the engine station it was necessary to keep seven oilers on each watch, calling for twenty-one oilers on three watches, with a capacity of 9000 kw. A 12,000-kw. or 15,000 kw. turbine can be run with one oiler on each watch. Thus it takes eighteen more oilers to get 9000 kw. on three watches from the engine plant than to get 12,000 kw. or 15,000 kw. from a turbine. The boilers at the engine station were of the hand-fired type, set in the floor, and the ashes had to be pulled out. It took ten of the twelve boilers to supply the six engines and required eleven or twelve firemen per watch—*i.e.*, thirty-three to thirty-six men for the three watches. In the turbine station only six or seven boilers were required to run a turbine, with three firemen on each watch.

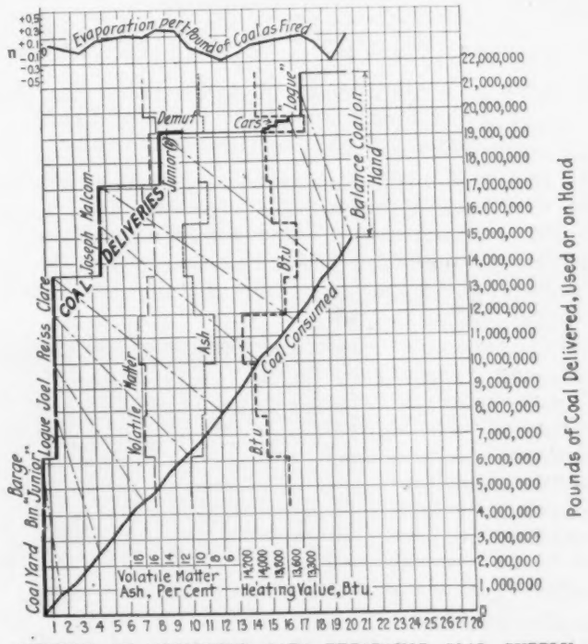
CHART WITH WHICH TO MAKE VARIOUS RECORDS FOR COAL

Shows Coal Delivered, Consumed and on Hand, the Characteristics of Each Lot, When Used, and Other Data

BY WALTER N. POLAKOV

With the present scarcity of coal the old slipshod manner of handling coal records should not be tolerated. By using the chart printed here the following information can be gained at a glance: (1) Quantity of coal on hand (bin or yard); (2) daily coal deliveries; (3) when unloading started and finished; (4) daily balance on hand; (5) heat value, ash and volatile contents of each delivery; (6) daily coal consumption; (7) coal consumption per kilowatt-hour; (8) cumulative consumption of coal to date; (9) on what day any certain coal was used; (10) the demurrage, if any.

The construction of the chart requires two main scales, namely, time (days of the month) and quantity (pounds of coal). The coal-consumed curve is started



METHOD OF RECORDING DATA REGARDING COAL SUPPLY, CONSUMPTION, ETC.

from zero on the first of the month, as shown, and grows gradually as coal is used from the overhead bin or yard each day. The vertical distance by which the curve rises from day to day gives the daily consumption, and the ordinate at the end of the line indicates the total coal used.

The amount of coal delivered is shown to the left of the coal-consumed curve, the grade being lettered opposite the line representing the quantity. The vertical bars representing the deliveries are divided to represent what portion of the total is in the overhead bin, what is in the yard pile, and how much is ready for unloading from the barges or cars. As the contents of each barge or car are consumed the length of the bar representing the amount of its contents is projected on the coal-consumed curve, indicating in this manner the duration of the period during which its load was utilized.

Whenever a new delivery is made a new bar indicat-

ing the amount is started on the day when the barge or car arrived at the dock or siding, while the horizontal line after each new delivery thus represents the time elapsed or periods between deliveries. The heavy part of the horizontal line represents the length of time during which the demurrage charges were accumulating.

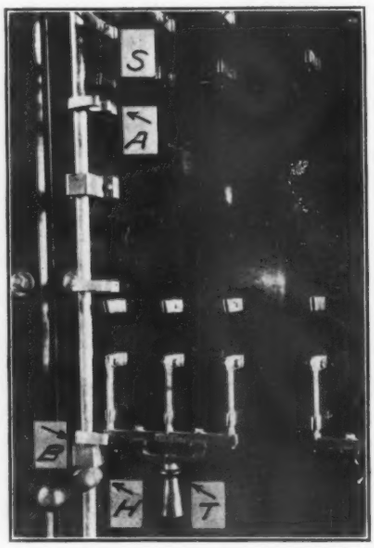
The analysis of coal for each delivery may be shown as complete as desired, being indicated horizontally opposite each delivery. In the case illustrated only the heating value, ash and volatile percentage are shown. In the upper part of the chart is a reference curve showing the evaporation per pound of coal. Any other relation, such as boiler efficiency or pounds of coal per kilowatt-hour, which may be of use can also be placed here.

To facilitate using these charts they can be plotted daily on cross-section tracing cloth, and blueprints can be sent from time to time (generally weekly) to the managers and purchasing agent.

INTERLOCK FOR SWITCHES TO PREVENT SHORT CIRCUITS

Consists of a Hard-Wood Rod Extending Up One Side of the Switch Panel and Carrying Seven U-Shaped Lugs That Engage with Switches

The switch-interlocking device illustrated herewith and used in the Colorado School of Mines might be employed in connection with other switching arrangements where it is desired to prevent short circuit. On the system in which it is now being used several different lighting circuits had to be energized and any one of seven sources of energy should be employed, but the loads on these separate sources, owing to the use of electricity for laboratory testing purposes, varied so that provision had to be made for serving any one of the several circuits from any one of the sources of energy.



INTERLOCKING DEVICE FOR SWITCHES

The old arc-board bus arrangement was adopted, the sources of energy being connected with horizontal buses running back of the switch lips, while the lighting circuits were connected with vertical buses running back of the switch hinges. The interlocking device consists of a hard-wood rod extending up one side of the switch panel and carrying U-shaped lugs, one for each switch position. Some of these lugs are shown in the half-tone at *A* and *B*.

From the arrangement shown it can be seen that if an attempt is made to close switch *S* when *T* is closed, lug *A* will intervene, thus preventing paralleling two sources of energy which may have different characteristics. The only way in which the switch can be closed is to throw back the handle *H* far enough to allow the switch to enter the U-notch in the lug. This can only be done by simultaneously opening the switches *S* and *T* or any other switch in that line which may be closed at the same time.

The original plan called for a steel rod or an iron pipe covered by an insulating tube, but the design was not approved by the Underwriters, so the hard-wood rod was substituted. It has proved to be very satisfactory, although not so strong as it should be. The spring holds the rod in the normal position, shown in the illustration, except when it is thrown back by the handle *H*.

The effectiveness of this interlocking arrangement is indicated by the fact that not a single instance of trouble has occurred in the six years that the board has been in use, notwithstanding the changing personnel of the operating force.

This scheme was devised by William J. Hazard, Colorado School of Mines, Golden, Col.

SAVING COAL BY MAKING USE OF CONDENSING WATER

Economic Gain by Using Same Water for Circulating Water in Condenser and for Make-Up to Feed-Water Heaters

An unusual but simple combination of feed-water and condensing-water equipment is employed in the plant of the Bloomington & Normal (Ill.) Railway & Light Company. The station carries a heavy steam-heating load in addition to its electric load and for this reason is mainly operated non-condensing. Most of the units are reciprocating engines. There is, however, one 600-kw. turbine which operates condensing since the engines use enough steam to supply the heating system at practically all times.

On account of the steam-heating system's requirements the plant needs considerable boiler-feed water. This is secured from a deep well by means of a 70-hp. motor-driven pump delivering about 600 gal. (2271 l.) per minute. The water from this well is received at 52 deg. Fahr. (11.1 deg. C.) the year round. As it comes from the well it goes to the condenser under the 600-kw. turbine as circulating water. It comes from the condenser at about 100 deg. Fahr. (37.8 deg. C.) and is then delivered to a 30,000-gal. (113,560-l.) temporary storage tank by a steam-driven pump. From this tank it flows by gravity to two 2500-hp. open-type feed-water heaters and is delivered to the boilers.

Since the water would have to be pumped for feed water in any event, the plan of using it as circulating water to give greater efficiency to the turbine and permitting it to pick up some heat on its way to the feed-water heaters effects an appreciable economic gain. D. G. Wallace, operating engineer for the Bloomington company, stated that the gain amounted to 1 lb. (0.435 kg.) of coal per kilowatt-hour generated by the 600-kw. turbine. This would amount to a saving of over 3.5 tons (3.17 t.) of coal a day with the turbine running at 50 per cent load factor.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

ECONOMIES IN MONTHLY BILLS AND RECEIPTS

Opportunity Not Only to Effect Savings but Also to Lessen the Burden on the Already Swamped Post Office

The necessity of practicing economies, even the penny-saving kind, is daily becoming more apparent to the electric lighting utilities of the country. Every expenditure is now being carefully watched to see if it might not be made smaller or abandoned, at least under these abnormal conditions. The savings thus effected benefit the public through steadier rates.

Expenses have risen in every department and have as a result reduced the net earnings of many properties even where the gross showed a substantial increase over the previous year. One of the latest increases to take place is that in post card and letter postage. This does not affect the monthly billing expense of a large number of properties because they operate almost entirely within the local post office zone. All properties, however, serving more than one locality, where these outside communities do not come within the local post office delivery, will feel this increase.

Already steps are being taken to minimize the expense of delivery of monthly bills. Not only does the question of postage enter but also that of stationery, which has increased considerably in price. A number of central stations have begun to deliver bills without envelopes by boys or girls, one company using the local boy scouts. Another practice that has been suggested is that companies serving many localities mail their bills, if they do not wish to discontinue mailing, in the locality in which the customer resides.

In some places meter readers are now employed as collectors, collecting the bills as the meters are read. In one place the meter readers make their readings one week and the following week they deliver the bills and make collections.

In the matter of receipted bills practically the same opportunity for savings obtains. Many properties have discontinued returning receipts unless requested, and many others no longer send receipts where bills have been paid by check. Here there is a visible labor saving in addition. The clerical service involved is alone greater than is generally realized. There is a further element involved, namely, the salutary effect on the post office. Under the operation of the selective draft a number of post office employees have been called for military service and more are waiting their call. Furthermore, the volume of mail has been increasing. Consequently any action that will lighten the excessive burden under which the postal officials are now staggering will mean just so much better service in the prompt delivery of the other mail.

In this connection is mentioned a movement among industrial concerns which is equally applicable to utilities—that to discontinue during the war the practice of sending to customers greetings at Christmas and New Year's. The savings that will be effected and the benefit to the post office are apparent.

One thing is certain—taxes will be heavier next year than ever, and in order that the utilities may pay their share, including both federal and local, and keep their heads above water, they must practice almost every apparent economy. Under existing conditions of higher costs the utilities are faced with the necessity of providing for these higher taxes, and savings here and there, both large and small, must contribute. Economies trifling in themselves will be found in the aggregate abundantly worth while, for here as elsewhere "every little helps."

ELECTROMAGNETIC HOIST SAVES TIME AND LABOR

By Its Use Hydrant Factory at Holyoke, Mass., Cuts Unloading Cost for Iron Pipe from $1.50 to 20 Cents per Ton

By the use of the electromagnetic hoist illustrated in Fig. 1 the Holyoke (Mass.) Valve & Hydrant Company has reduced the time of unloading pipe from the

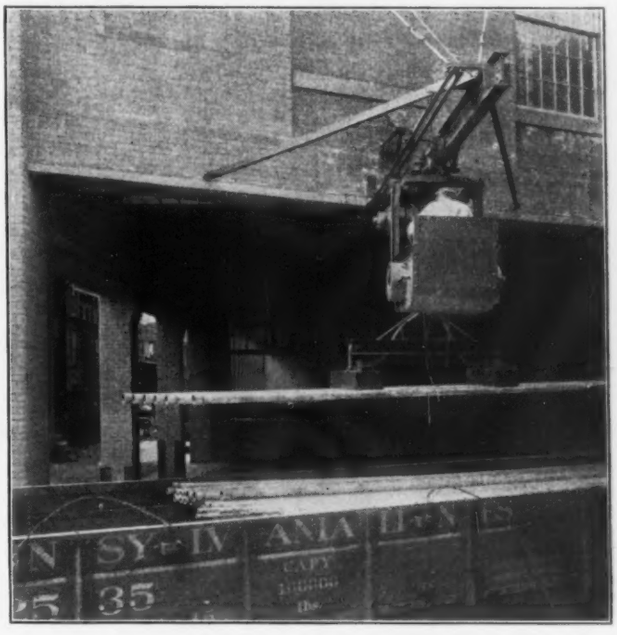


FIG. 1—ELECTROMAGNETIC HOIST AT PLANT OF HOLYOKE VALVE & HYDRANT COMPANY

car from a former time of six to seven hours to three hours, including placing the pipe in the storage racks shown in Fig. 2. The hoist has a rating of 1 ton (0.9 t.), a lift of 22 ft. (6.7 m.), and runs on a monorail structure extending through the plant. Its horizontal

speed is 350 ft. (106 m.) per minute, and the hoisting speed is 40 ft. (12 m.) per minute. From the railroad side track to the nearest bin a run of about 80 ft. (24 m.) is required, and the average travel to the bins is 125 ft. (38 m.). The monorail extends through the

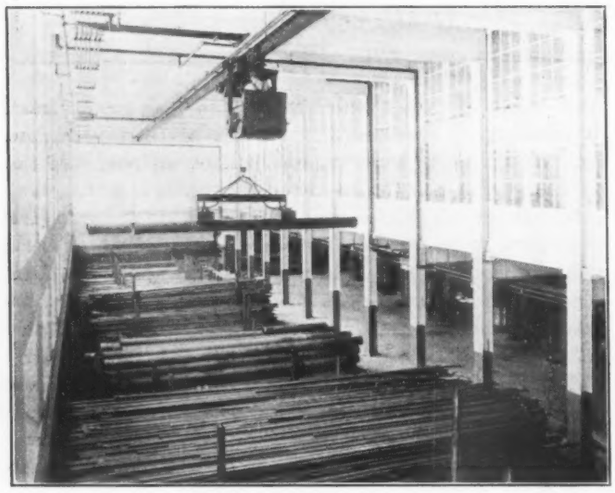


FIG. 2—ELECTROMAGNETIC HOIST READY FOR LOADING TRUCKS FROM STOREHOUSE

plant to a shipping platform (Fig. 3), at which deliveries can be made as required directly to the waiting motor trucks.

The hoist, which was built by the Shepard Electric Train & Hoist Company of Montour Falls, N. Y., is equipped with two 4-hp., 220-volt Sprague direct-current motors, energy being supplied from the local alternating-current power circuits through a 7-kw. General Electric motor-generator set receiving energy at 550 volts. The electromagnets, which are attached to a pair of channel irons bolted back to back as shown,

FIG. 3—ELECTROMAGNETIC HOIST LOADING AUTO-TRUCK AT SHIPPING PLATFORM

weigh 500 lb. (226.7 kg.) each and were built by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. These are operated in parallel and are 14 in by 20 in. (35.5 cm. by 50.8 cm.) in face, taking 1.9 amp. each at 220 volts. The connecting bar is about 5 ft. (1.5 m.) long and weighs 99 lb. (50 kg.), so that the combined dead weight of the bar and magnets without load is about 1100 lb. (498 kg.). When the hoist is not in service the bracket shown on the outside of the building in Fig. 1, from which the traveler depends, is lifted on hinges out of the way of passing trains on the side track.

The electromagnetic hoist is used about two hours a day. Purchased at a 1916 price of $2,500, it has saved the labor of two men and cut the cost of unloading from car to shed from $1.50 to 20 cents per ton. From 8 tons to 10 tons (7.2 t. to 9 t.) per hour can be loaded into trucks from the storehouse. This storehouse, with the hoist in position for work, is shown in Fig. 2.

ROUTINE NECESSARY FOR GRANTING SERVICE

Simple and Easily Understood Forms for Contracts, Deposits and Guarantees and Their Method of Application

BY H. W. DERR

Contract Agent the Pittsfield (Mass.) Electric Company

In dealing with the public the idea should be borne in mind to make it as easy as possible for all to do business with the utility. As the first business transac-

PITTSFIELD ELECTRIC CO.

Pittsfield, Mass., ... *191*

For Value Received *of the* PITTSFIELD ELECTRIC CO;

do hereby guarantee to said Company the payment of all bills which the said Company may have against ..... *for Electric Current consumed by said at No.* .....

Street, in said Pittsfield.

FIG. 1—FORM OF GUARANTEE THAT HAS BEEN FOUND A BETTER SAFEGUARD THAN ASKING A DEPOSIT

tion between the customer and the lighting company is his signature on the application for electric service, the application, naturally, should be made as simple and easy to understand as possible, so that any one entirely unfamiliar with the numerous electrical terms can understand it.

The application shown on the opposite page (Fig. 2) is a simple one that the writer uses and it seems to answer all legal requirements. Only three times has it been necessary to test the legality of this form. In two of these cases the company was successful, and in the third the delinquent failed before suit conld be instituted. All of which goes to show that the real value of the application is to get the correct name and address of the subscriber, and the simpler this form can be made the fewer questions will arise as to the legal value of this document.

The application for service when received is given to a clerk whose duty it is to see that a card is filled out properly, from which a record is made and sent to the meter department for the installation of the meter and a record given to the accounting department. This card is then filed alphabetically, so that it can be referred to in case of a change of address or other question, and a geographical index is then compiled from these records.

When it is difficult for a customer to get in touch with the company officials service is installed and the details are arranged later. The good will and favorable publicity obtained by being anxious to serve greatly

Name _____ No. A _____

Address _____

Formerly occupied by _____

_____ hereby make application to the PITTSFIELD ELECTRIC COMPANY for electric service at premises of above address, occupied by _____

as a _____ and agree to pay for same promptly at regular rates and according to rules of said Company, and also to be responsible for all regular charges for the service until forty-eight hours after notice has been duly given at office of Company to discontinue service.

It is further agreed that duly authorized agents of said Company shall have free access to the service main, meter and connections at all reasonable hours for testing and repairing, and may also upon _____ failure to comply with any of the rules of the Company, discontinue the service and remove the meter

Signed _____

By _____

CUSTOMER'S RECORD FOR NEW BUSINESS DEPT.

ACCOUNT ENTERED DATE _____ BY _____

DEPOSIT No. _____ $ _____ CREDIT RATING _____

Card to go to Bookkeeper and Filed.

Job Ticket to Install / Read Amp. Meter Made Out by _____ Date _____

FIG. 2—FRONT AND BACK OF APPLICATION FORM

offset the small loss which accrues from bad accounts in this connection.

In a great many cases the commercial department and the meter department work to each other's advantage. When a request for service is made by telephone and an application is necessary, the meter department can in a great many cases secure the application and deposit at a great deal less expense than the commercial department, thus doing away with the necessity of two trips for the sake of a technicality.

Should a customer refuse to sign the regular form of application containing the rules and conditions of the company, it is a rule that service should immediately be discontinued, because a public service corporation cannot afford to make special cases with any individual or group. If a rule is right, the customer will quickly see it; if it is wrong, it must be changed sooner or later.

As it is necessary to maintain a department to handle meters, all work in connection with meters is left to this department; that is, it is held responsible for all readings from incoming and outgoing customers.

The Pittsfield company finds it advisable to ask every new customer to make before installation a small deposit, equal to one month's bill, because of the large number of the so-called shifting population. The deposit receipt, like the application, has been made as simple as possible so as to avoid confusion. It has been the writer's practice to make this out in triplicate, the original copy going to the customer, one copy to the accounting department, and the third copy being kept by the salesman for reference. Fig. 3 shows a copy of the deposit receipt, which has been found to be most successful.

As long as the payment of a deposit is required, no credit investigation is made, provided, of course, that the customer continues paying his bills promptly. As the deposit asked for is in most cases so small, it is kept by the company as long as the customer continues to take service.

The service is discontinued immediately in the event of the customer vacating the premises, thereby giving the meter department a correct and accurate list of all meters in service and the accounting department a correct and accurate list of customers. These methods have been found to be advisable because they enable the company to clean up the ragged ends which cause so much detail and annoyance.

Should a customer wish to take out new service when he already has an outstanding bill he is asked to pay up this outstanding bill before new service is granted. The legal ruling, however, is that if a customer wishes to pay in advance for any new service, a public service corporation will not be permitted to refuse to give him this service.

When a customer leaves town with his electric light bill in arrears and his address is known to the company, this information is forwarded to the electric light company from which he would take service. When a customer discontinues his service his deposit is returned to him upon presentation of the deposit receipt. In the event of a customer losing his deposit receipt he is required to sign an affidavit stating that this receipt has been lost and relinquishing all claim to it. Stress also is given to the necessity of keeping these receipts and returning them at the closing of the account.

In a great many cases it has been found advisable to have some responsible party guarantee an account.

PITTSFIELD ELECTRIC COMPANY

OFFICE OF THE
PITTSFIELD ELECTRIC CO.

No. 291 A

_____ 191____

Received from _____

No. _____ *Street*

_____ *Dollars, as security for the payment of debts which may be contracted with this Company, which amount is to be refunded in final settlement, the bills meanwhile to be paid regularly, as rendered. This receipt is not transferable, and should be returned to this office upon ceasing to use electric current, on removal, or when another party takes the place. Four per cent. on the above amount paid annually.*

PITTSFIELD ELECTRIC CO.

$_____ *By* _____

FIG. 3—DEPOSIT RECEIPT ISSUED TO CUSTOMER

These guarantees are entirely acceptable, and it has been found that they have a greater tendency to lead to satisfactory accounts than any deposit which could be obtained. Fig. 1 is a copy of the company's form of guarantee.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

PREVENTING ELECTROLYSIS OF IRON IN CONCRETE

Investigation Indicates that Anode Corrosion May Be Materially Decreased by Coating Metal with a Porous Film of Paint

BY W. A. DEL MAR AND D. C. WOODBURY

IF AN iron bar be set in a block of concrete in the presence of an electrolyte and made one of the electrodes of an electrolysis test unit, some interesting phenomena will be revealed by observing the apparent electrical resistance* of the unit. When the iron bar is made the anode the original resistance is usually low, but rises and reaches in the course of a few months at least fifty times the original value, as shown in Fig. 1. When the iron bar is the cathode or is subjected to an alternating current, so that little or no corrosion occurs, the electrical resistance remains small and practically constant.

The question naturally arises: Where is this high resistance located and what causes it? Various theories have been advanced, which are briefly summarized as follows:

(1) Location—surface of cathode. Cause—polarization.

(2) Location—free electrolyte outside the concrete block. Cause—exhaustion of conducting ions in the water.

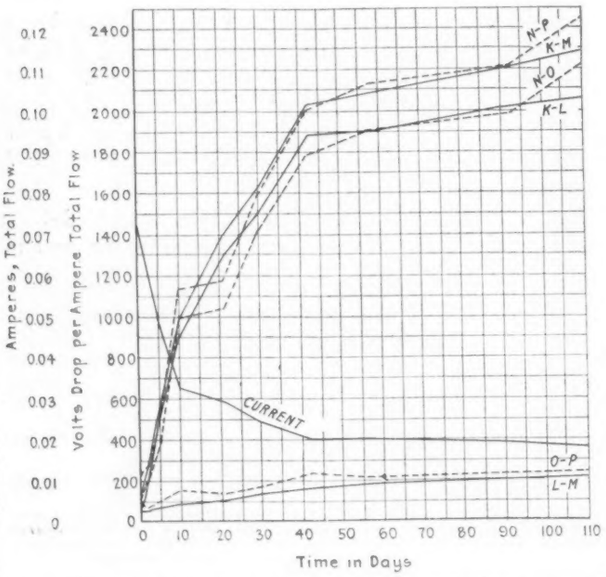


FIG. 1—RESULTS OF TESTS MADE WITH SET-UP SHOWN IN FIG. 2

(3) Location—surface of concrete block. Cause—Clogging of pores of concrete by chalk.

(4) Location—restrained electrolyte in the concrete block. Cause—exhaustion of ions, or drying by endosmose.

(5) Location—concrete. Cause—chemical deterioration of the concrete.

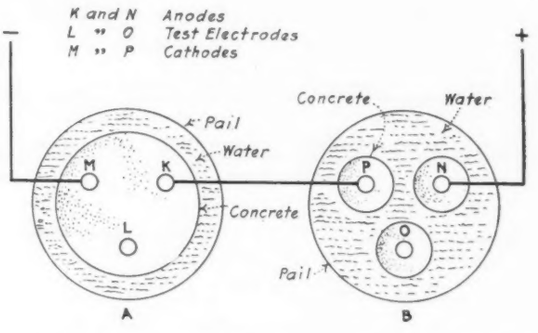


FIG. 2—ARRANGEMENT OF ELECTRODES FOR MAKING ELECTROLYSIS TESTS

(6) Location—surface of anode. Cause—film of nonconducting rust.

To determine which of these theories, if any, is correct the following tests were made by the authors: Two electrolysis units were prepared, one consisting of three iron bars set in a single block of concrete supported on porcelain insulators in a tin pail containing water, and the other consisting of three iron bars, each set in a separate block, each block being supported on porcelain insulators in a tin pail of water, as shown diagrammatically in Fig. 2. New York City (Croton) water was used. The electrodes were spaced the same in both units, so that the only difference between the units was in the method of surrounding the electrodes with concrete. Voltage was applied almost continuously for 120 days and periodic current and voltage readings were taken.

The location of the high resistance was determined by a process of elimination which is described below, the paragraph numbers referring to the theories advanced above. (1) It could not have been at the surface of the cathode, because the cathode resistances *O-P* and *L-M* (Fig. 2) were small and practically constant. (2) It could not have been in the free electrolyte outside the concrete block, because the rise of resistance occurred in both test units and there was no free electrolyte in the circuit of unit *A*. (3) It could not have been at the surface of the block, because the circuit in test unit *A* did not cross the surface of the concrete. (4) It could not have been the restrained electrolyte in the concrete block, because if so the cathode resistances *L-M* and *O-P* would have been substantially the same as the resistances *K-M*, *K-L*, *N-P* and *N-O*, which was not the case. (5) It could not have been the concrete block

*Throughout this article the word "resistance" will be used to designate the volt ÷ ampere ratio, regardless of whether it is true resistance or back electromotive force.

itself for the same reasons. (6) The resistance, therefore, must have been located at or near the surface of the anode.

The primary cause of the rise of resistance was the corrosion of the iron, as proved by the following observations: Block *KLM* cracked at *K* five days after voltage was first applied, and block *N* on the eighth day, both *K* and *H* being anodes. When the units were broken at the conclusion of the test both iron bars were found to be greatly corroded. Cathodes *P* and *M* were clean and bright. The concrete around *P* was in perfect condition, but that around *M* was slightly softened. Test electrodes *L* and *O* were only slightly rusted and the concrete was in good condition. There was no trace of chalk in the body of the concrete block *N* and only a small amount at the surface and in the crack.

During the course of the test the current was stopped for a short time and resistance measurements were made immediately upon its restoration. It was found that the apparent resistance had fallen considerably and required time to regain its former value. If the increased resistance were due to the film of rust, which remained intact during the short stoppage of current, why should the resistance have fallen? The answer is to be found in the phenomenon known as endosmose or electric osmosis, which is briefly described as follows:

An electric current flowing through a porous partition filled with conducting liquid causes a flow of the liquid through the partition. The direction of flow of the liquid is the same as that of the current, *i.e.*, from the anode to the cathode in an electrolytic cell. The iron rust in the test units under consideration acts as a porous partition, and while current is flowing moisture is driven from the iron-bar anode, keeping the rust film dry. Upon stoppage of the current moisture enters into the rust, lowering its resistance. Upon reapplication of the current the moisture is gradually expelled from the rust and the resistance rises until the rust is dry, when a steady condition is again attained.

This action was demonstrated visually by filling the bend of a glass U-tube with iron rust and shifting a column of water in one branch of the tube to the other and back again by passing current between electrodes, first in one direction and then in the other. A current of 0.05 amp. moved about 1 cu. cm. of water in four hours through 10 cm. of rust in a tube 7 mm. inside diameter. Upon reversal of the current the water was shifted back to the other branch of the U-tube. The rust near the anode became absolutely dry and the moisture was gradually driven out of all the rust except that near the cathode surface.

Tests with painted iron bars showed that when a current was passed through it a film of paint underwent a change in resistance like a film of rust. That this was due to endosmose was proved by making a painted iron bar the cathode in a water bath and observing the formation of water bubbles under the paint film. Such bubbles were not formed when the painted bar was made the anode. This proved that water could be forced through the paint by endosmose.

(a) An iron anode, in water or any moist medium, accumulates a film of rust which acts as a porous cell and becomes dry by endosmose, thereby removing the electrolyte and reducing the current, the net effect being to protect the iron from further rapid electrolytic corrosion.

(b) Corrosion does not take place according to Faraday's law, because a large part of the energy of the current is used in the osmotic transportation of water through the rust, thereby lowering the so-called efficiency of corrosion.

(c) Anode corrosion may be decreased by coating the iron with a porous film of paint which is kept dry by endosmose. Hence protective paints should be highly insulating, as endosmose cannot take place through conducting partitions.

The authors wish to acknowledge the co-operation of A. E. Ellis and C. B. Martin in making this research

Lamps and Lighting

Code of Lighting.—Continuation of an article discussing the illumination of factories, mills and other workplaces. Among the subjects discussed are using the shop forces, distribution of expense and yearly appropriations, reflectors and their effort on efficiency, avoiding dark spots, comparison of glass and metal reflectors; reflector maintenance; two ways to secure side lights, advantage of mounting lamps high, maintenance of lamps and wiring, and a method of inspection and maintenance.—*Proceedings* of Engineers' Club of Philadelphia, September, 1917.

Generation, Transmission and Distribution

Overhead-Line Specifications for Crossings.—The specifications which were adopted Feb. 27, 1917, and which went into effect in June, 1917, apply to the overhead conductors of any utility in Pennsylvania crossing over the right-of-way of any other utility, be it a communication, transmission or transportation company. The specifications were prepared at the request of the Public Service Commission of Pennsylvania under the direction of its chief engineer by a joint committee representing the different classes of utilities concerned. They are as far as possible complete for all types of conductors and cover definitely the general requirements at the points of crossings without stating the type of construction in such specific detail as to limit it to any particular method. The specifications are divided into nine sections. Section 1 covers definitions and sets forth classifications. Section 2 covers the construction of power lines up to 5000 volts crossing communication circuits and power lines up to 7500 volts when crossing power lines of other utilities. Section 3 covers the construction of power lines of more than 5000 volts crossing over communication lines and of power lines of more than 7500 volts when crossing over power lines of other utilities. Section 4 covers the construction where one line is built parallel to an existing line but on separate support and is so placed in reference to it that one line will be wholly or in part over the other. Section 5 covers construction and communication lines where crossing over railroads, and is based on the specifications for wire crossings adopted by the Association of Railway Telegraph Superintendents. Section 6 covers the construction lines of all voltages where crossing over railroads. Section 7 covers the construction of overhead lines crossing under railroad bridges. Section 8 covers underground construction at points of crossing with railroads. The appendices include tables for use in connection with sections 2 and 5; specifications for wooden poles; sag curves for use in connection

with sections 3 and 6; suggested methods of conductor attachment for use in connection with sections 3, 6 and 7; methods of calculating strength of double cross-arms for use in sections 3 and 6; allowable working unit stresses for use with sections 3 and 6; short-span construction; methods of tying conductors to insulators for use in section 5; suggested methods of underbridge attachments for use with section 7; calculations of a typical crossing of power line over railroad; wooden-pole construction in which crossing poles cannot be side guyed, and miscellaneous tables covering minimum clearances, minimum separation of conductors, wind and ice loads, and permissible loading for chestnut, Western cedar and Western white-cedar poles. —*General Order No.* 13, Pennsylvania Public Service Commission.

A Comparative Study of Dams in Hydroelectric Construction.—E. MAYNARD and P. LÉVY-SALVADOR.—The authors, recognizing the difficulty and expense involved in erecting the great dams necessary in hydroelectric installations in mountainous country, have investigated in an exhaustive manner the comparative advantages of stone, reinforced concrete, metallic and mixed dams. Their conclusion is that it is not possible to select a material that will always be the best. A separate comparison must be made for each case to determine the most desirable plan to adopt.—*Revue Gén. de l'Elec.*, Sept. 15, 22 and 29, 1917.

Wires, Wiring and Conduits

Electric Code.—Rules adopted by the Industrial Board, Pennsylvania Department of Labor and Industry, covering methods for installing protective grounding of circuit equipment and lightning arresters for stations, lines and utilization equipment. These rules became effective July 1. 1917.—*Journal of Engineers' Club* (Philadelphia), October, 1917.

Units, Measurements and Instruments

True Temperature Scale of Tungsten and Its Emissive Powers at Incandescent Temperatures.—A. G. WORTHING.—This paper describes a method of determining the emissive power of a substance at incandescent temperatures and also a method for determining the wave lengths to which brightness, temperature and emissive power measurements made with the aid of colored glass pyrometer screens are to be ascribed. The emissive power of tungsten at 0.467μ and 0.665μ as a function of the temperature has been determined for temperatures up to 3200 deg. K. In the latter also is given the relation between the true temperatures and the brightness temperature at 0.665μ for tungsten. From the consideration of these and other data, 3675 deg. K. has been selected as the most probable value of the melting point of tungsten. Previous data on the thermal conductivity and on the Thompson effect have been recomputed on the basis of a new temperature scale and the radiation intensity has been determined as the function of the temperature.—*Physical Review*, October, 1917.

TABLE I—PREVIOUS DATA CORRECTED TO NEW TEMPERATURE SCALE

T in deg. K.	k in $\frac{\text{Watts}}{\text{Cm.} \times \text{Deg.}}$	$10^{-8} \times \frac{k}{XT}$ in C.G.S. Units	σ in $\frac{\text{Microvolts}}{\text{Degree}}$	E in $\frac{\text{Watts}}{\text{Cm.}^2}$	$\frac{T}{E}$	$\frac{dE}{dT}$
1500	1.01	2.80	.....	5.7	5.21	
1700	1.07	3.06	.....	10.8	5.06	
1900	1.12	3.29	−20	18.8	4.93	
2100	1.17	3.50	−24	30.6	4.81	
2300	1.21	3.69	−28	47.2	4.70	
2500	1.25	3.87	.....	69.7	4.60	
2700	1.29	4.02	.....	98.9	4.50	

TABLE II—TEMPERATURE RELATIONS FOR TUNGSTEN ON BASIS OF $C_2 = 14{,}350\mu \times$ DEG. AND Tau = 1336 DEG. K.

S at $\lambda = 0.665\mu$	ϵ at $\lambda = 0.665\mu$	$T - S$	ΔT in Case $\frac{\Delta\epsilon}{\epsilon} = +0.01$
1200	0.457	56	−0.7
1400	0.451	76	1.0
1600	0.446	102	1.3
1800	0.440	132	1.7
2000	0.434	168	2.2
2200	0.428	208	2.7
2400	0.422	254	3.3
2600	0.416	306	3.9
2800	0.410	366	4.6
3000	0.403	433	5.4
3176*	0.398	498	6.2

*Melting point:

Telegraphy, Telephony and Signals

Coupling Coefficient of Two Coaxial Flat Spiral Coils.—P. BAILLIE.—Formulas are developed for calculating the coupling coefficient of two coaxial flat spiral coils such as are being used extensively to form the tuning and coupling inductances in wireless apparatus. Curves are given from which the constants and the mutual induction coefficient of two circles in the formula may be obtained graphically.—London *Electrician*, Sept. 21, 1917.

Miscellaneous

Temperature Variation of the Electrical Conductivity of Mica.—H. H. POOLE.—A description of experiments made to determine the variation of electrical conductivity of mica with temperature. Results of the test confirmed the formula $C = aXe^{bx}$, in which C is the current density, X the potential gradient and a and b are constant. For one sample tested the constant a was approximately proportional to the sixteenth power of the absolute temperature over a temperature range of 0 deg. C. to 47 deg. C and b was independent of the temperature. For another example a was proportional to the 15.47th power of the absolute temperature from 50 deg. C. to 229 deg. C. and b was independent of the temperature. Although the values of a were widely different in the two cases, the values of b were almost identical. The fact that b is independent of the temperature does not agree well with the suggestion that the exponential term is due to a distribution of electronic energy in accordance with Maxwell's law. It also appears from the observation that the electric constant does not vary much up to 230 deg. C.—London *Philos. Magazine and Journal of Science*, September, 1917.

Readers' Views and Comments

Water Power and the National Emergency

To the Editor of ELECTRICAL WORLD:

Sir: Your editorial entitled "The Penalty of Sloth," published Sept. 29 last, not only admirably states the case but constitutes a sharp commentary on the legislative dilatoriness sometimes found in our country, so many of whose citizens have made it great in industrial enterprise largely because the nation's inventive genius has been encouraged and has developed to an unequaled degree. This requires a vision unfortunately too often lacking where it is needed—one of the results perhaps of our proneness to delegate our lawmaking to the legal fraternity, for is it not a fact that the mental processes of a profession trained to rely on precedent must fail in the imagination that dreams of exploitation of new fields?

Again referring to your review of the situation, does not its logic carry the conviction that Congress could properly at this time push to completion, as war emergency measures, the legislative plans affecting water-power development so long in the making? There is seen to be no inconsistency in such a course when we reflect on its possibilities, a few of which should be driven home by reiteration.

Approximately 10,000,000 water horsepower has been projected in an engineering way, and this awaits only federal legislation to materialize soon, if the circumstances repeatedly described by high authority are correctly comprehended. What does this mean? It means the saving of 8,000,000 tons of coal (the equivalent of 240,000,000 barrels of oil) per annum and the transfer to other fields of imperative war demands of 168,000 railway cars, 6000 locomotives and 738,000 men—in round numbers, based on conservative estimates prepared by competent engineers of unquestioned standing.

Furthermore, we are distinctly derelict in failing to follow the example set by our sister republic—France—which, under conditions infinitely more restrictive than any which have yet afflicted us on account of this war, suffering for three years past from the most frightful invasion of history and called upon to oppose the brutal assaults of an extraordinarily powerful enemy with every able-bodied male citizen, either at the front or in war-supply factories, deems the development to-day of its waterpower a matter of prime importance. Very recently the appointment of an Under Secretary of State to push the development of French waterpower was strongly advocated, and otherwise there is evidence of an acute interest in this enterprise truly edifying. France in this way seeks to serve an end the importance of which is brought home to us by the present trying circumstances of our daily life, imposed on us by the exigencies of our high democratic aim.

Under normal conditions conservation of exhaustible fuel by inexhaustible means and a constructive utilization of the human effort thus released in other important enterprises would be creditable to our national intelligence and highly advantageous to our national welfare. The present frightfully abnormal conditions, which have disorganized every phase of our national endeavor, should show clearly wherein we have failed to make full and wise use of our unbounded natural resources, the neglect of which constitutes an inexcusable and wanton extravagance easily prevented if conditions were as they would be under a far-sighted and patriotically wise governmental regulation.

W. W. NICHOLS,
Chairman American Industrial Commission to France.

New York.

The Use of Kirchhoff's Laws

To the Editor of ELECTRICAL WORLD:

Sir: To separate from all the equations furnished by Kirchhoff's laws those that are independent is a problem which has probably confronted every one who has had occasion to solve a complicated circuit. The purpose of this letter is to show that the two laws are necessary and sufficient, and at the same time to point out a way of avoiding unnecessary equations.

In our discussion we will assume that all resistances which are connected merely in series are considered as one, so that at each junction point we shall have at least three wires. Let R_1, R_2, R_3, . . . be given resistances and E_1, E_2, E_3, . . . given emfs. Let it be required to find the corresponding currents I_1, I_2, I_3, . . . Then the laws may be stated as follows:

(1) $\Sigma I = 0$ for every junction point,

(2) $\Sigma IR = \Sigma E$ for every closed path.

An equation may fail to be useful either by becoming an identity or by being derivable from other equations.

Suppose that the first equation becomes an identity, *i.e.*, $\Sigma I = 0$ for any set of values of I's whatever. This can take place only when the equation has a form $I_s - I_s = 0$ or, in other words, when only two wires are joined at the point. But by our assumption such points are not to be considered.

Suppose, further, that the second equation becomes an identity, i.e., $\Sigma IR = \Sigma E =$ constant for any set of values of I's whatever. This can be true only when each R is equal to zero, which is impossible. Hence, equations furnished by Kirchhoff's laws cannot become identities.

Suppose now that the equation (2) can be derived from (1), or vice versa. This necessitates that in the second equation $\Sigma E = 0$ and all R's are equal to each other. Our equations can then be written:

(1) $\Sigma I = 0$

(2) $\Sigma IR = R\Sigma I = 0$

For these equations to be equivalent, for each I_p in the first equation there must be an identical I_p in the second, and vice versa. In this case the portion of the circuit under consideration will consist of a series of loops of equal resistance joined at one point. It is easy to see that exactly half of the signs of I's in the first equation will differ from those in the second. Consequently the two equations cannot be equivalent. Therefore the equations furnished by one law are independent of those furnished by the other.

Let the number of I's (equal to the number of R's) be N, and the number of junction points P. Then, the number of independent equations furnished by the first law is $P - 1$, because any $P - 1$ points can be taken in such an order that each equation will contain at least one unknown not contained in the others. The last point will, of course, give no independent equation. $P-1$ is always less than N, hence the necessity of the second law.

Now, if the second law be applied to a closed path passing through each junction point once and only once, then it will be easy to write all the other equations so that each of them includes one and only one unknown not contained in any of the previous equations. The number of the unknowns in the first equation of this type being P, the total number of the independent equations obtained by thus applying the second law will be $1 + (N - P)$, which together with $P - 1$ equations furnished by the first law gives the necessary N equations.

B. PODOLSKY.
Southern California Telephone Company, Los Angeles, Cal.

Logarithmic Notation

To the Editor of ELECTRICAL WORLD:

Sir: Would it not be generally advantageous to adopt a common system for indicating whether a logarithm is to base 10 or base e? Some textbooks give "log x" as being "$\log_e x$" and specify the base for other systems, as for example "$\log_{10} x$." On the other hand, other books call "log x" the common log, or $\log_{10}$, and specify "$\log_e x$" when the hyperbolic logarithm is meant. It appears to the writer that as such a beautifully simple system is in use to distinguish between the trigonometric functions—*i. e.*, "sin x," "tan x," etc., for circular functions, and "sinh x," "tanh x," or "Sinh x," "Tanh x," as used by some writers, to indicate hyperbolic functions—it should be a fairly simple matter to distinguish between the two generally used systems of logarithms in some similar manner. For instance, "log x" or logt x" would indicate "$\log_{10} x$," and "logh x" would indicate "$\log_e x$," or the "hyperbolic logarithm of x." The notation I suggest would be very convenient for typewriting, and I should imagine rather more convenient for printing, than the system of indices now in use. It would further remove the confusion due to the different usages of various authors as noted above.

Preston, Idaho. F. M. GILLESPIE.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

REGULATION OF SIGN LIGHTING IS NEARER

No Effort Is Being Exerted by Washington Authorities to Do Away with All of Such Illuminations—Conservation the Aim

It became known in Washington on Wednesday afternoon that the Fuel Administration intended to issue within a day or two the rules and regulations which will govern electric sign lighting in the United States for some time to come. Dr. Garfield, the administrator, stated to the Washington representative of the ELECTRICAL WORLD that the Fuel Administration has not been wholly in sympathy with statements made to it in behalf of electric lighting companies, such as that it requires but 7 tons of coal each night to carry on the electrical sign lighting for the city of Chicago. He said he had been told, for instance, that it requires but 2¾ tons of coal each night to accomplish the sign lighting for the city of New York. Dr. Garfield expressed himself as frankly incredulous of these statements.

A committee has been working on the rules and regulations for some time. There is no disposition on the part of the Fuel Administration to do away with sign lighting. The effort has been toward conservation, and the conservation division of the Fuel Administration has received from engineers in the industry diagrams showing that the peak load in electricity comes about 6 o'clock in the evening, when most lights are turned on, when factories have not entirely closed down and when urban railways are most heavily loaded. These advices had been adopted by the Fuel Administration. For this reason it was believed that a method of conservation would be the beginning of sign lighting at about 8 o'clock in the evening instead of earlier as heretofore.

It is expected in Washington that another priority order, governing the use of open-top flat cars for the shipment of coal, will be put in force soon. The coming order, according to statements made at the transportation priority office, will limit the coal supply to plants manufacturing so-called non-essentials. No information is obtainable as to the order in which the non-essentials will be graded. One official of the government volunteered the opinion, for instance, that the manufacturer of pianos would come away down in the list, and there is reason to believe that all other luxuries will share that fate. There is no reason, however, for anxiety on the part of important industries using electricity, according to statements made in Washington.

The Washington representative of the ELECTRICAL WORLD reports that the country will probably receive shortly the announcement that the following policy has been decided upon in regard to the supply of coal, so far as both the priority transportation board and the Fuel Administration are concerned:

The railroads of the country will be supplied first. The fleet and auxiliary warships will be supplied second The public utilities will be supplied third, with a conservation of sign lighting along the lines indicated above. Steel plants manufacturing munitions of war will be supplied fourth. Domestic users will be supplied fifth, with a conservative effort directed toward starting plants later at night than they have heretofore been started—in the case of apartment houses, for instance, starting both lighting plants and steam heating plants at a later hour than has been the custom during the winter months.

A committee representing the motion-picture industry conferred during the week with the Fuel Administration, declaring the belief that a very large amount of electricity is being wasted which could be saved by suggested readjustments.

SIGN OWNERS URGE A COMPROMISE PLAN

Broadway Property Holders, Trying to Save the Greatest White Way, Suggest Limitation of Energy Supply

A memorandum submitted to Dr. Garfield, the Fuel Administrator, by the Broadway Association of New York suggests a compromise plan of dealing with electric signs. It says in part:

The passage of the daylight saving bill (which has been passed by the Senate but not by the House) would bring about a saving, as stated by one of the officers of the Daylight Saving Association, of about $50,000,000 in coal annually.

It is suggested that if it is absolutely essential that exterior lighting be reduced, a consumer be only permitted to use 66 2/3 of the amount of any energy that he may have used for exterior lighting during the preceding year, and that no new exterior lighting be permitted until April 1, 1918, at which time this order could then be reissued or conditions could be reviewed as they were at that time. This, however, is not to refer to any alteration of existing exterior lighting installations, as such changes on exterior lighting are necessary from time to time so long as the total consumption of energy does not exceed 66 2/3 of the prior year's consumption. This would permit the following alternatives at the option of the consumer:

That a consumer reduce the number of lamps used for such exterior lighting, or that he may reduce the wattage of the lamps used, or that he may reduce the number of hours that the lamps be burned. This arrangement would be so elastic as to meet the requirement of nearly all users.

If even more drastic action is necessary, it is suggested that kerosene be permitted to be used for exterior illumination.

It is suggested that the question be borne in mind that if the income of the public utilities companies be reduced to too great an extent it may not be possible for them to continue manufacturing at existing rates, and that application might be necessary to have the rates raised; if this is so the increased cost to a consumer should be borne in mind.

Any great darkening of thoroughfares would drive people from the thoroughfares into interiors, and the increased use of houses or interiors would cause increased consumption of energy in houses or interiors.

ACTION ON SIGN LIGHTING BY NATIONAL COMMITTEE

Hearty Support Is Pledged to the National Authorities in Carrying Out Any Plan Which They Consider to Be Necessary

The National Committee on Gas and Electric Service at a meeting held in Washington on Nov. 1, passed the accompanying resolution on electric sign lighting.

COMPANIES SUPPORT FUEL ECONOMY

Whereas, under the extraordinary conditions arising out of the state of war, the public is visually impressed by the apparent waste of fuel which it believes to be involved in the lighting of the electric display signs, so conspicuous a feature of the life of our larger cities, notwithstanding the fact that, even in the aggregate throughout the country, this service requires the consumption of an inconsiderable percentage of the total coal required for the operation of electric power plants generating electrical energy; and

Whereas the continued use of such electric signs apparently renders more difficult of consummation the efforts being made by the national authorities to urge the public to conserve and economize in the consumption of all the necessaries of life and the elimination of all waste and extravagance, real and apparent, in the use of the commodities essential to our nation and its allies in the successful prosecution of the war; and

Whereas exterior display lighting of the different kinds is of varying degrees of necessity and importance to the general public and to the business communities in which it is operated, depending upon the immediate purpose which it serves, and

Whereas, if and when the national authorities decide that the time has arrived when it shall appear to them to be necessary in the national interest and for the purpose of impressing on the people the importance of avoiding all waste and extravagance to call public attention to the necessity of practicing economy in the use of fuel in industries, in the factory and in the homes of the people, they should then issue a pronouncement to the people of the United States requesting them, under the supervision and direction of the proper state and municipal authorities, to limit the use and operation of advertising, billboard and display signs, exterior publicity lighting and special ornamental street lighting of every kind to that which is important and necessary for the convenience and safety of the public and for the proper conduct of the various business and commercial enterprises in the respective communities, and to render effective their co-operation in this work, be it therefore,

Resolved, that the public utility companies throughout the United States, through their organization, the National Committee on Gas and Electric Service of the Council of National Defense, representing the gas companies—both natural and artificial—the electric light and power companies, the waterworks companies and the central steam-heating companies throughout the country, pledge their hearty support and co-operation to the national authorities in carying out any plan or regulation for the saving of fuel, gas, oil or electricity which the national authorities in the public interest may consider it necessary to adopt as a war measure.

The committee also had a conference with Dr. Harry A. Garfield, the Fuel Administrator of the federal government.

ELECTIONS NOT CENTERED ON PUBLIC UTILITY ISSUES

Tammany Wins Four-Cornered Fight in New York City—Massachusetts Administration Sustained, Notwithstanding Attack on Higher Fares

Campaigns which ended in the elections on Tuesday of this week appear to have had no marked general significance affecting public utilities, although in some local cases there was a slight angle which was of interest.

In New York City the Tammany candidates won in a four-cornered fight in which the issues were confused. One of the planks in the Tammany platform was public ownership of utilities, but this did not become an active issue during the campaign.

In Massachusetts the electorate sustained the war administration of Governor McCall by a majority of nearly 100,000. Mr. Mansfield, the defeated candidate for Governor, failed utterly in an attempt to gain favorable decision by attacking among other things the 6-cent electric railway fare developments under the present régime.

Business houses in general in Chicago breathed a sigh of relief when the election returns on Nov. 7 showed total defeat of all Socialist candidates for position as judges of the Superior Court. There was, however, no very great fear at any time that the Socialist ticket would succeed in a big way. In some individual cases the Socialist candidates have been active against public utilities, and the success of these individuals would of course have been viewed with apprehension. In general, however, the fear of Chicago business houses seemed to be based on the fact that the Socialist candidates were inexperienced, while on the fusion ticket the candidates were mostly sitting judges. War-time economy showed itself in the bond issue elections, the one-million-dollar good roads issue being the only one carried.

CLASSIFICATION PLAN OF ILLUMINATING ENGINEERS

In Keeping with the General Policy, the Illuminating Engineering Society Will Make Personal Classification—Non-Members Included

In accordance with the general policy of engineering societies in making a classification of members, the Illuminating Engineering Society is asking for information of the experience and availability of each member for service of either a military or a civilian nature.

A letter from Clarence L. Law, the general secretary, says that the classification and the index to be prepared therefrom will prove of sufficient value during the war to justify the expense incurred and will probably prove of increasing value after peace has been declared in taking care of the readjustments in the industries of the country and providing for the employment of engineers in such a way that the services of each man will be utilized to the best advantage of both the engineers and the country.

The society is also making a classification of non-members so that all men qualified to hold positions in the arts or sciences of illuminating engineering may be similarly recorded.

PRIORITY IN POWER REQUIRED IN OHIO CITY

Canton Business Men Seek Modification of Government Order That War Industries Be Given the Greater Part of Energy Supply

Following a conference of seventy-five business men at Canton, Ohio, last week, a delegation went to Washington in an attempt to secure modification of a priority order which requires the Central Power Company to furnish the greater part of its energy to the United Alloy Steel Company and the Timkin Roller Bearing Company, which are making war materials. These men declared that a number of factories will be compelled to close if they do not secure the service they need from the central station.

General Manager F. H. Golding of the Central Power Company informed the business men that the station had been practically commandeered by the government and that he can do nothing unless a modification of the order is secured. The rating of the station is 17,000 kw., while the two plants mentioned require 12,200 kw. daily, leaving but 4800 kw. for other purposes. Should the draft upon the station be heavier, it is probable that some of the lighting service would have to be dispensed with for the time.

Recently the Mayor of Canton confiscated about 300 tons of coal belonging to the Central Power Company. This was the last of a large storage supply created by the company about two years ago at a point three miles from its plant.

FOR COUNTRY-WIDE COAL CONSERVATION

"Reconsider the Advantage of Buying Heat and Power from a Specialized Plant That Makes Nothing Else"

A country-wide coal conservation movement has been started by the committee on coal conservation of the Chamber of Commerce of the United States. This committee is composed of:

Ernest T. Trigg, chairman, president Philadelphia Chamber of Commerce, vice-president John Lucas & Company, paint manufacturers.

Lester P. Breckenridge, professor of mechanical engineering, Sheffield Scientific School, Yale University.

Thomas E. Donnelley, president R. R. Donnelley & Sons Company, printers, Chicago.

P. H. Gadsden, president Consolidated Railway & Lighting Company, Charleston, S. C.

Ira N. Hollis, president Worcester Polytechnic Institute, president American Society of Engineers and chairman Engineering Council.

Frank H. Johnston, president City Coal & Wood Company, New Britain, Conn.

John S. Lawrence, textile manufacturer, Boston.

John W. Lieb, vice-president New York Edison Company, president National Electric Light Association.

John F. McGee, member Minnesota Commission of Public Safety, Minneapolis.

Charles E. Wales, retired coal operator and distributer, Minneapolis.

To owners and managers of power plants the committee says:

Costs of production have more attention to-day than ever before. The cost of coal for generation of power has in many instances not had the same consideration as other costs, because coal has been cheap and obtainable in abundance. Cheap coal and cheap labor sometimes made it apparently economical in dollars and cents to install and run an inefficient plant.

Coal has now become expensive. It is hard to obtain. Efficiency in its use and avoidance of waste have become of first importance, since without power other materials cannot be utilized.

These conditions make it imperative for every owner or manager of a power plant to examine into the cost of the power his establishment uses, the economy with which it is generated and applied, and the increase in efficiency that is possible. Some of the steps that an owner or manager should take are to:

Reconsider the advantage of buying heat and power from a specialized plant that makes nothing else and can afford the investment and supervision that gets a maximum of value out of each pound of coal (in some localities hydroelectric power may be available).

Find the nearest source of coal that will meet the requirements, even if it does take a little more trouble to use it. The tax on the transportation system will thus be reduced so far as haulage by rail is shortened. Coal is mined in twenty-six states, and these states extend practically across the continent and from the northern to the southern borders.

Give to the power plant and its personnel recognition and encouragement such as is due an expert and important department, thus getting new effort and attention to offset the extra attention and care needed with coal inferior in grade and preparation to the coal formerly available.

Seek to increase skill and proficiency in the men who handle the coal. A fireman at a hand-fired boiler shovels 3 to 10 tons of coal a day—or as great a value in material as many skilled men in other departments.

Put the fuel-using equipment into as perfect condition as possible. Provide at hand-fired plants an ample firing floor with a good surface, together with a smooth-bottomed coal car if it can be used; eliminate leaks in the boiler setting; see that fire-doors fit properly, replace defective grate bars, make sure that smoke connections are clean and tight; if mechanical stokers are used, see that they are in good repair and that directions for using them are being followed; in general, make the plant and the fire-room of such character that an efficient man will stay on the job.

Install simple and convenient means by which the fire-room force may see results. Scales for weighing fuel and ash, meters for measuring water fed to the boiler, and devices for determining the quality of flue gases, the draft over the fire, etc., can be made to interest the men in the fire room and show the actual results of efforts to economize. Convenient means for operating the flue damper must be installed.

Endeavor to run boilers in service at their capacity. If efficiency is increased, one or more boilers in a battery may be dropped.

Provide water that is free from scale by using, when necessary, water-treating devices if the plant is large, and special feed-water heaters in small plants.

Reduce loss of heat after it is generated. See that boiler services and steam pipes are properly covered. The simplest and most inexpensive covering will reduce loss by 80 per cent. In the engine room cut out useless steam lines, have valves properly set, reduce the small auxiliary pumps, etc., to a minimum, provide the repairs the engineer has been asking.

Obtain expert advice. Good steam engineers are familiar with well-tried ways of reducing both consumption of coal and consumption of heat. Their advice should be obtained in all practical cases. This is not a time for radical innovations but for utilizing tried experience.

One pound of coal per hour has yielded a horsepower per hour. That is the record of present possibility. It cannot by any manner of means be attained by every plant. But the fact that at present the average attainment throughout the country is but one-third or one-fourth of this record is indicative of the possible savings that can be made if the care and attention which the power plant deserves are actually given to it.

The suggestions which have been given above are typical of the points about which every owner and manager of a power plant should assure himself. The applicability of

any general suggestions will vary with nearly every plant.

Most users of coal can join in promoting efficiency of coal. Railways have made real progress in firing locomotives; they can often go farther. Gas works can generally effect further saving by using careful technical direction. Manufacturing plants of every degree can show great results in the aggregate.

The Bureau of Mines, on behalf of the federal government, has gathered a great deal of information about the use of coal and has expert advice to give regarding means of economy. Some of the publications in which the Bureau of Mines has embodied the results of its experiments and made practical suggestions based upon expert observations and conclusions of its staff and other engineers are indicated in the attached list. [This list comprises a number of suggestive technical papers.—EDS.] In many instances state agencies, too, have data and suggestions which are to be had for the asking.

ACUTE COAL SHORTAGE STILL THREATENS OHIO

In Order to Keep Municipal Plant in Cleveland in Operation City Confiscates Four Carloads of Coal

While most Ohio industrial and utility plants have been kept in operation in the last week, coal has been so scarce that many were continually in danger of being closed down. Owing to the fact that mines were ordered to ship all coal to dealers for domestic purposes on Oct. 29, the regular supply for steam purposes, heretofore shipped on Mondays, was eliminated.

In order to keep the municipal light plant in Cleveland in operation, Mayor Harry L. Davis confiscated four cars of coal on the New York Central Railroad tracks at East Fifty-fifth Street, that city, on Nov. 2. It was consigned to the American Steel & Wire Company. This is the first time for some weeks that the municipal plant has been entirely without coal.

On Oct. 31 Charles Wood, general manager Ada Heat, Light & Water Company, Ada, notified the authorities that unless coal was received at once the plant would have to suspend operations. As further complaints have not been noted, it is probable that at least a small supply has been furnished.

The central station furnishing Tiffin with energy (the Ohio Light & Power Company) had trouble on Oct. 31 because of coal shortage and at times the town was in darkness. On the following day some of the factories in that city were closed, as debris floating in the stream after a freshet forced the discontinuance of operation until the trouble was remedied.

In Toledo the coal supply has been very short, but so far railroad and light plants have been kept in full operation. A survey of the city needs for industrial purposes has been made and an attempt will be made to secure a sufficient amount of coal for all plants through the State coal administration, of which Attorney Homer H. Johnson of Cleveland is the head.

The suspension of all sign and surplus street lighting is being discussed in Cleveland. In an interview on Nov. 3 Coal Administrator Johnson said that no step has been taken toward this end, but he believes that it will come to that point before long. This would result in saving quite an amount of fuel, he said, although it would disturb central station business for a time. He believes, further, that it may be necessary to stop production of non-essentials where fuel is required.

MAINE CONSOLIDATION WILL EFFECT ECONOMY

Proposed Merger of Electric Companies Will Avoid Two Taxes on the Same Income and Promote Economic Advantages

To avoid paying two war taxes on the same income and also two franchise taxes, as well as to secure economic advantages resulting from centralization of corporate organization, a petition was filed recently with the Maine Public Utilities Commission by the Gould Electric Company of Presque Isle and the Maine & New Brunswick Electric Power Company. The petitioners sought to consolidate the Maine property of the Maine & New Brunswick company into the Gould company.

H. T. Powers, for the Maine & New Brunswick company, stated that $90,000, or 90 per cent of its income, is derived from Maine, the balance being obtained from small plants in New Brunswick. All the electricity used is generated in New Brunswick. About 128 miles (206 km.) of transmission line are in service in Maine, eleven companies and municipalities being supplied at wholesale. The company owns a distribution plant in Presque Isle, and the Aroostook Valley Railroad is supplied with power from this system. The property of the company in Maine is valued at $600,000. It is estimated that, after paying 1.5 cents per kilowatt-hour for energy, the present Maine income will provide a 5 per cent dividend on the capital stock after making allowance for operating expenses. About 3,200,000 kw.-hr. will be furnished by the New Brunswick company, at about $48,000; operating expenses will be about $12,000; maintenance of transmission lines $3,000, insurance and taxes $3,000.

War and income taxes in Canada are larger for a given volume of net earnings than in Maine. It is proposed to issue $600,000 stock, and if the commission allows the Maine property of the system to be taken over extra income and war taxes amounting to $16,000 will be saved. On these terms it is figured that the property will show a surplus in Maine operations of $2,000 per year. New towns are being taken on, and every distribution plant is being extended.

A. R. Gould of Presque Isle, general manager of the Maine & New Brunswick company, described the pioneer development of the property, the principal plant being at Aroostook Falls, just over the Canadian border.

Energy is generated at 11,000 volts and delivered at this pressure to Fort Fairfield; from there to Houlton, 45 miles (72.4 km.) a 33,000-volt line is in service. Farm power is supplied from the Presque Isle distribution system, the lines running 5 or 6 miles (8 km. to 10 km.) into the country. A larger proportion of residents take electric service in the Presque Isle district than in adjacent parts of Maine. Business increase has been better in 1917 so far than a year ago.

Mr. Gould said that although the present is the dryest period the plant has experienced, about 4000 hp. is running to waste. The capacity of the principal generating plant is about 3000 hp. as at present developed, but there is some demand, notably at Van Buren, for power for pulp-mill service. An immediate market of 1000 hp. additional could be utilized if storage should be created on the river. The value of the property of the company in New Brunswick is about $500,000.

WAR SERVICE COMMITTEES FOR ELECTRICAL MANUFACTURERS

Member Organizations in the Electrical Manufacturers' Council Appoint Committees to Co-operate with Government

At a meeting of the Electrical Manufacturers' Council in New York on Nov. 2 steps were taken to assure the appointment of war service committees by the member organizations—the Associated Manufacturers of Electrical Supplies, the Electrical Manufacturers' Club and the Electric Power Club. This action is in accordance with a request made to the Chamber of Commerce of the United States by Director W. S. Gifford of the Council of National Defense. It will make closer the co-operation between the government and electrical manufacturers on war matters.

SAFETY ORGANIZATION THAT GREATLY REDUCES ACCIDENTS

Plan Which Has Been Found Thorough and Practical by a Long Island Company, and Some of the Results Obtained

An outline of the safety organization of the New York & Queens County Railway Company of New York and statistical results which show its efficiency are given below, the information being extracted from a report sent by W. P. Strickland, general inspector of the company, to Charles B. Scott, secretary of the committee on safety rules and accident prevention of the N. E. L. A. The plan has been found to be thorough and practical.

The company has a centralized safety bureau which makes constant inspections of the entire system. A schedule is maintained whereby every man attends a "safety first" lecture and first-aid and resuscitation drill once a month. The first-aid and resuscitation drills are actual demonstrations, every man participating, thus insuring full and proper instruction. "National Safety Council" matter and other accident prevention suggestions, including pictures, are placed on the bulletin boards weekly, many of the warning signs posted by the company appearing in several languages.

At the monthly drills all rules are reviewed and prizes are given quarterly for the best suggestion as to how to prevent accidents. Each superintendent, foreman and acting foreman is supplied with a copy of "Safety Engineering," and the plan of voting on the best article under the heading, "The Man on the Job," as well as discussion of all articles, is encouraged.

A comparative statement of accidents is distributed monthly among the several divisions. This records the number of accidents that occurred in a department during a given month and the percentage of accidents based upon the number of employees in the department. The record also includes a tabulation headed by the division with the highest percentage of safety, as well as a comparison with the previous year.

A "safety committee," composed of the superintendents and the heads of all departments, meets at regular intervals to act upon suggestions sent in by the employees and discuss safety construction.

Every suggestion is acted upon promptly. After the suggestions are voted upon by a safety committee a letter of acknowledgment is sent by the treasurer to each person who submitted one. This evidence of the company's appreciation "boosts" the interest in safety and has stimulated the work among the employees.

In the last three years accidents have been reduced 49 per cent. During the first ten months of 1917 the reduction in accidents was from 40 to 50 per cent more than the corresponding period of 1916, indicating the increased precautions taken as result of the work.

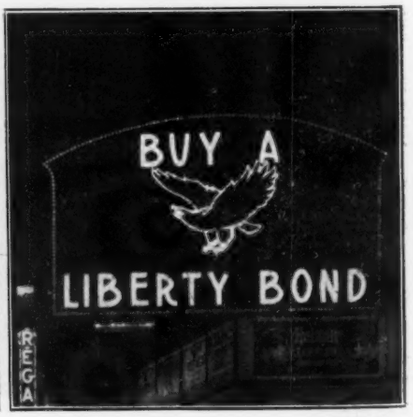
In the accompanying table is given a summary of the accident report of the company for three years ended December 31, 1916.

	1914	1915	1916
Average percentage of annual gross earnings expended for accident costs	0.0081	0.0076	0.0054
Average percentage of annual payroll expended for accident costs	0.0227	0.0217	0.0181
Total number of fatal accidents	6	1	1
Number of employees (average)	472	544	553
Percentage of decrease in accidents to employees from year 1913	11	32	49

ELECTRIC SIGNS FOR THE LIBERTY LOAN

Advertising the Second National Bond War Issue to the Crowds in Broadway Districts, New York

In the issue of the ELECTRICAL WORLD for Oct. 6 one of the signs donated to the government to advertise the second Liberty Loan was illustrated. Three other signs which were used for the same purpose are illustrated herewith, the Budweiser sign and also two donated by the O. J. Gude Company, the wreath and eagle. All were in or near Broadway, New York.



TAX ON EXCESS PROFITS UNDER WAR REVENUE ACT

Commissioner of Internal Revenue Roper Invites Associated Manufacturers of Electrical Supplies to Make Suggestions to Board

In a letter to the Associated Manufacturers of Electrical Supplies Daniel C. Roper, Commissioner of Internal Revenue of the Treasury Department, Washington, directs the attention of that organization to the excess profits provisions of the war revenue act.

Mr. Roper says that the Secretary of the Treasury desires to administer these provisions in a manner that will accomplish the full purpose of the law and cause as little inconvenience as possible to the business interests of the country. To this end the Secretary has created an excess profits advisory board to analyze the law and to digest and consider in connection with plans for its administration the suggestions received from those who will be required to pay the taxes. Mr. Roper adds:

> You are respectfully invited to submit to the Bureau of Internal Revenue any suggestion you may desire to offer with respect to the interpretation, application or administration of the excess profits provisions of the new law. You are particularly requested to outline the method of computing "invested capital," under Sections 204, 207 and 208 of the excess profits tax law, which will be most practicable and accurate for those engaged in the industry which you represent. You may find it advisable to refer this matter to several sub-committees of your association, in which case it is hoped that you will act as a clearing house for the purpose of eliminating duplicate suggestions from your line of industry and in assisting to keep the work of the advisory board within proper compass.
>
> In this invitation you are being given an opportunity to render a valuable service to your country. I shall thank you for submitting your suggestions in the form of a memorandum at the earliest possible date.

The association will take steps to meet the request.

REWARDS FOR EFFICIENCY AND REDUCTION IN RATES

Indiana Public Service Commission Finds Opportunity to Apply the Plan of Sliding Scale Stimulation to Skillful Operation

The Indiana Public Service Commission has inaugurated a practical policy of rate regulation of public utilities from which large results are expected. The commission, in deciding the rate case of the Hydroelectric Light & Power Company, which supplies Connersville, East Connersville and other towns near by, applied a system of rate control which has been tried in Oxford, England, and some other European cities. It is based on the general theory that for every step forward in plant economy, plant efficiency and resulting rate reduction to the company's customers the investment returns to the stockholders of the company are automatically increased, thus placing the highest possible business premium on good management.

E. I. Lewis, chairman of the Indiana commission, who has been seeking a utility rate case among those that have come before the commission as an experimental possibility for the "Oxford system," said that he believes the Connersville case presents an ideal case for the experiment. Gov. James P. Goodrich, whose deep study of the utility-control problem has continued for years, is anxious to see the immediate application of the new scheme of rate control, and the experiment undoubtedly will be watched with the deepest interest by utility experts throughout the United States.

The Connersville company is the successor to the Light, Heat & Power Company and to the Hydroelectric Light & Power Company, which were merged into the present company on Jan. 1, 1917. By petition which was filed later the commission was asked to promulgate a rate basis for the new company, which would be based on reasonable and just underlying principles. The commission has determined to try the new system of "rate reward control" on this plant. The Connersville plant is considered an ideal plant for the trial of the new scheme because of its lack of bond issues and other complicating conditions.

PROMOTING INTERNATIONAL STANDARDIZATION MOVEMENT

H. M. Hobart in London as Delegate of Standards Committee of the American Institute of Electrical Engineers

H. M. Hobart is in London as a delegate of the standards committee of the American Institute of Electrical Engineers to confer with the British Engineering Standards Committee. He will confer with the panel committee on rating of electrical machinery, of which Sir Richard Glazebrook is chairman.

Sir John Wolfe Barry, chairman of the British Engineering Standards Committee, and Sir John Snell, chairman of the sectional electrical committee, welcomed Mr. Hobart on Oct. 17, the first day of the rating conference. It was announced in London that the presence of Mr. Hobart in London would afford an opportunity for consultation in regard to the standardization of electrical apparatus generally, in connection with which much work is being carried out by various panels of the committee, especially in respect of motor starters, ships' fittings, fuses, instruments and instrument transformers, under the direction of C. H. Wordingham.

As on the previous occasion at the rating conference, the Canadian national committee of the International Electrotechnical Commission has invited A. P. Trotter to represent it.

The visit of Mr. Hobart to London means the third conference to be held in the last few years between the representatives of the English and American standardization committees. In February, 1915, Mr. Hobart and C. E. Skinner went to England. In June, 1916, C. le Maistre, secretary of the British committee, returned the visit by coming to this country.

In its work the American committee has been in very close contact with the British committee in the entire field of electrical standardization. In all essential features the rules in England and in this country are almost equivalent. No really vital differences remain. The two committees are now simply taking advantage of the experience of each other to promote international standardization. The very cordial relations existing between the two committees and the large measure of success which has attended the previous conferences are conspicuous developments for the international standardization movement.

VALUATION TOTALS FOR THE CLEVELAND COMPANY

Ohio Commission Announces Figure of $19,600,000, Whereas Company Contended for $24,400,000 and City Demanded Only $11,900,000

The contest between the city of Cleveland and the Cleveland Electric Illuminating Company on rates has resulted in what might be called a draw, according to the ruling of the Ohio Public Utilities Commission, issued on Nov. 2. This ruling places the valuation of company property at $19,661,242, which is too high to permit the 3-cent rate provided for in the city ordinance passed two years ago. The next duty of the commission in this case is to fix the rate on the basis of the ruling. It may not be as high as at present, since the company contended that the proper value of the property is $24,489,644, but neither can it be as low as the city demanded, since its contention was for a valuation of $11,913,016.

Under the ruling the physical property is valued at $14,809,500 and intangibles at $4,851,742. As the valuation is of July 1, 1914, the commission will add the amount expended in extensions and improvements since that time to secure the proper basis for the present rate for service. Including items other than those of property for electrical purposes and property not used and useful, the order gives the entire valuation of the company property as $21,428,987.

The commission tentative valuation was $20,820,062, but the cost of financing and a few other items, amounting in round numbers to $1,034,660, were dropped from the valuation. The city contended that intangible values to the amount of $6,087,158 should be deducted, but the commission did not agree with arguments to this effect.

One feature of the ruling was the allowance of $1,112,070 for attaching business, which the city attorneys contended is opposed to a decision of the Supreme Court some time ago. They also argued that city consumers should not pay rates based on the value of property used to supply East Cleveland, Lakewood, Rocky River and other suburbs. These things, it is understood, the commission did not take into consideration, because they place limitations that are too narrow for the best interests of all.

The company has asked the commission for the privilege of issuing $3,500,000 bonds, and at the same time it requests the cancellation of its right to issue $1,039,000 common stock, which was granted some time ago.

REUNION AT DEDICATION OF THE EDISON TABLET

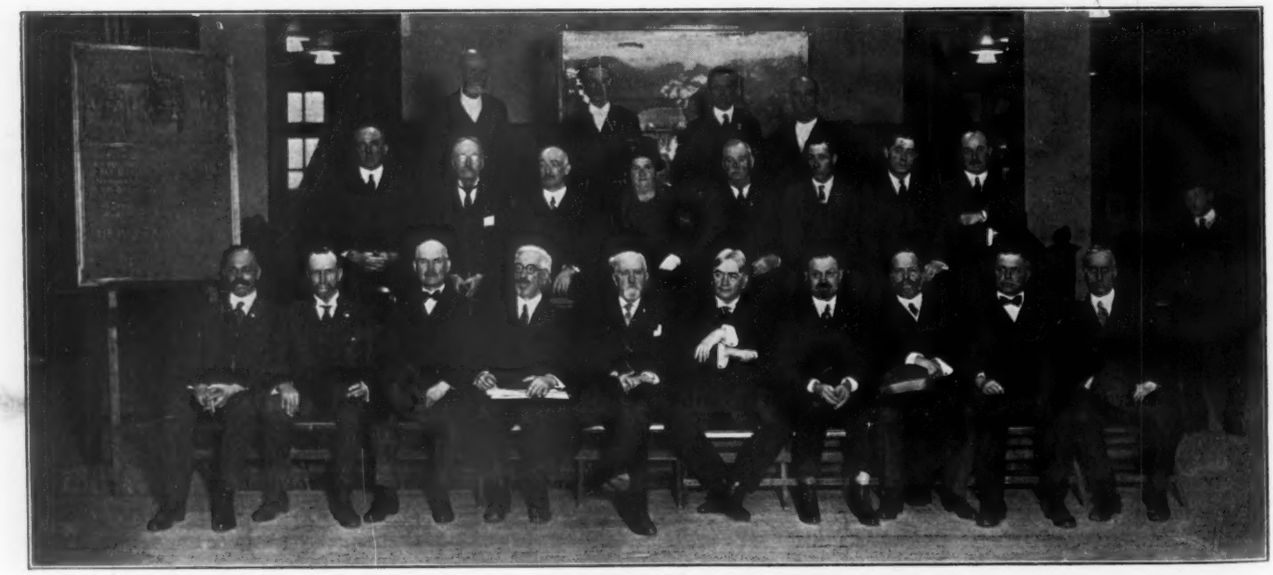
Twenty-two of Those Who Worked with the Inventor in Pearl Street Station Are Gathered Together

As stated in the Oct. 20 issue of the ELECTRICAL WORLD, a large bronze tablet commemorating the thirty-fifth anniversary of the establishment of electric lighting in New York City was dedicated at the Electrical Exposition on Oct. 18.

A feature of the exercises was the gathering of twenty-two of those who worked with Edison in establishing the central station at 257 Pearl Street, where the tablet is to be placed later. All cheered enthusiastically when it was announced that Edison was too busy helping to win the war to have time to attend the event.

Among the central station pioneers who gathered at the reunion were Dr. William J. Hammer, Dr. Schuyler S. Wheeler, E. A. Harley, H. A. Campbell, Joseph Lee, A. T. Brown, O. J. P. Lang, A. F. Gilbert, W. J. Brown, J. F. Atkins, T. T. Wooley, John Acheson, Wilson S. Howell, Richard Darlington, Thomas Brown, W. T. Dempsey, Mrs. Nellie Curran, Andrew Brown, John W. Lieb and Arthur Williams.

The old Pearl Street building, which has been reconstructed, is now occupied by Mangus, Maybee & Renard, dealers in oils. In erecting the tablet the American Scenic and Historic Preservation Society and the New York Edison Company have co-operated, the Scenic society being interested because of the historic importance of the event and the Edison company because the company of 1882 was the parent of the present organization.



CENTRAL STATION PIONEERS AT EDISON REUNION

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Injuries to Fellow-Employee When Electric Mine Hoist Dropped.—An engineer whose duty was to operate a mine hoist carrying miners to and from a lower level was as to such miners a vice-principal for whose acts the operator was liable, the Supreme Court of Utah held (167 P. 675). It is therefore not objectionable to charge both the mine owner and a hoist operator with negligence resulting in injury to a miner by the dropping of the hoist. An engineer whose duty was to operate a mine hoist carrying miners to and from a lower level was not, as to a miner injured by the negligent dropping of the cage, a fellow-servant. It is negligence as a matter of law for an electrically operated hoist cage in a mine to be dropped 110 ft., without brake or clutch, with such force as to injure a miner therein, though the case is not strictly one of *res ipsa loquitur*.

Shutting Off Service for Non-payment.—An injunction is the proper remedy to prevent the shutting off of water by a water company where the consumer denies in good faith the amount of the charge, the Court of Appeals of Maryland held (101 A. 771). Although a water company may adopt a rule that water may be shut off for non-payment therefor, it cannot arbitrarily shut off the consumer's supply where the amount claimed is a matter of just dispute. The Public Service Commission is not invested by law with power to determine controversies between defendant water company and plaintiff consumer as to correctness of the bills rendered. Although it be conceded that the commission has jurisdiction in cases involving the correctness of charges for water, it cannot deprive a court of equity of its original jurisdiction to grant an injunction for refusal to supply water.

Water Rights During Withdrawal of Grants.—Under a statute providing that whenever, by priority of possession, rights to use of water have vested and accrued and are recognized by the local customs, laws and decisions of courts the possessors and owners of such vested rights shall be maintained and protected in the same, and the right-of-way for the construction of ditches and canals for the purposes specified is acknowledged and confirmed, a locator for water rights acquires no title against the United States till the work is completed; so that before that time, the lands affected being temporarily withdrawn by executive order of the Secretary of the Interior, and Congress having before the vacation of the orders of withdrawal granted the lands and rights to a city, all rights thereto of the appropriator were lost, the Supreme Court of California held in Silver Lake Power & Irrigation Company versus the city of Los Angeles (167 P. 697).

Commission Jurisdiction Over Municipally Operated Utility.—Under its charter, authorizing it to construct or purchase waterworks and reservoirs or to grant to any person or corporation a franchise or permission for the construction of waterworks, including the right to use the streets, etc., a city council passed an ordinance providing that plaintiff should construct and maintain a water plant in consideration of a payment of $12,000 by the city and a lease of the plant for twenty years. The ordinance required the city to acquire land for a reservoir site and right-of-way thereto, as well as rights-of-way for all water mains, and allowed plaintiff during the twenty-year period to charge fixed water rates. The laws declare that the intention of the Legislature should be pursued, if possible. The law confers on the Public Service Commission authority over every public utility, but declares that no plant owned or operated by a municipality shall be deemed a public utility. The Supreme Court of Oregon held (167 P. 791) that the water plant was owned by the city, which had dominion over it, as title to the reservoir and rights-of-way was taken in the name of the city and the mains were laid in the streets, which by the charter were declared to belong to the city in fee, and hence the Public Utility Commission had no jurisdiction to supervise the rates.

Recovery Under Workmen's Compensation Act.—Under the workmen's compensation act, providing that whenever an injury for which compensation is payable shall have been sustained under circumstances creating in some other person than the employer a legal liability the injured employee may proceed both against the employer and such other person but shall not collect from both, the collection of compensation by a telephone lineman from his employer did not estop him from recovering damages from defendant city for injuries due to its failure to insulate electric wires, the act simply preventing plaintiff from collecting from the city more than the excess over the sum he had collected from the employer, it was held by the Court of Appeals of Kentucky (1975 W. 449). Where the lineman had recovered for injuries from his employer the employer was a necessary party in a suit for damages against the city for its failure to insulate its electric wires, in view of the workmen's compensation act, giving the employer the right to recover from a negligent third party the amount of indemnity he had paid the employee under the act. In a suit by a lineman injured by contact with electric wires of the city the award and other proceedings against the company employer under the workmen's compensation act were wholly immaterial to the questions involved.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Competition Opposed in New York.—Denying the application of the Lawrence Park Heat, Light & Power Company, Bronxville, for authority to compete with the Westchester Lighting Company, the New York Public Service Commission, Second District, holds that to allow competitive lighting systems would be in deliberate disregard of the law and settled policy of the State and would impose a condition from which the public might in the end be a heavy sufferer. The Lawrence company sought to furnish the business section of that village with electricity and thus compete with the Westchester Lighting Company. Originally the Lawrence company was only intended to light buildings owned by the members of a family that owns the light company. The Lawrence interests constructed new buildings, stores, residences and business blocks, and served these properties with electricity from their own plant, in some cases ejecting the Westchester Lighting Company from these buildings and the tenants' places. This, Commissioner Emmet states, represented to the Westchester Lighting Company a considerable loss of business which it had confidently expected to get. Since the Lawrence company was in a position to take this business over without seeking any public franchises, there was nothing the Westchester Lighting Company could do to prevent it. In August, 1916, the village granted the Lawrence company certain franchises. A street-lighting system involved the placing of wires underground, but under conditions the Westchester Lighting Company could not accept. The Lawrence company accepted the lighting contract. In a case of this kind, Commissioner Emmet says: "The question arises whether or not the circumstances are such as to require a rigid enforcement of what is now conceded to be the settled attitude of New York State toward wasteful competition between public utility companies." Commissioner Emmet points out that in the great majority of cases in years gone by competition between utility companies operating in a single field had produced very bad results from the points of view both of the public and the competing companies. "It was recognized that this kind of competition," Commissioner Emmet writes, "almost invariably resulted in the partial or complete crippling of enterprises which were subject to it, with the inevitable result that utility companies generally were not giving anything like as good service to the people as they might reasonably be expected to give under happier and saner conditions."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Increase in Rates in Kentucky.—The Kentucky Public Service Company, Bowling Green, Ky., has asked for an increase in rates for electricity and gas, due to the advance in operating costs.

Galena Company Establishes New Output Record.—During the week ended Oct. 20 the Interstate Light & Power Company, the Galena (Ill.) division of the Northern States Power Company, reached its largest single day's output of electrical energy, amounting to 116,000 kw.-hr.

Engineering Courses in Brown University.—The division of engineering of Brown University is beginning this year to inaugurate a revised course in engineering whereby the studies are closely the same for three years, the greater part of the specializing being reserved until the senior year.

Notes Sold by Chicago Company.—The Public Service Company of Northern Illinois has sold $1,500,000 two-year 6 per cent notes to Lee, Higginson & Company and Halsey, Stuart & Company, Chicago. The notes, which are secured by $2,000,000 first and refunding 5 per cent bonds, will be offered at about 97½ to yield 7⅜ per cent. They will be redeemable at 100½ if redeemed before April 1, 1919, and at 100 on and after that date.

Building Costs.—Building costs compiled by Russell B. Smith, civil engineer, co-operating with the Dow Service Daily Building Reports, show that the advance in electric wiring cost is less than in other items. According to the compilation building costs to-day, instead of being from 50 to 60 per cent above the costs before this country went to war, are not more than 30.7 per cent over costs ruling in 1914-15, when the building at the southwest corner of Thirty-eighth Street and Madison Avenue, New York, was estimated on. The actual gains in construction, separated into their various departments, show architectural terra cotta to have advanced 27.7 per cent; boiler stacks, 229.5; electrical wiring, 25.4; carpenter work, 5.1; elevators, 87.6; excavation, 29; exterior limestone, 30.4; fireproofing, 53; glass and glazing, 125; granite, 37.8; hardware, 31.4; heating, 132.7; interior marble, 20; mail chute, 10; masonry, 22; metal doors, 25; ornamental iron, 77.7; painting, 128.5; plastering, 22.5; plumbing, 41.2; plumbing fixtures, 35; roofing and sheet metal, 31.5; sprinklers, 129.4; stair treads (asphalt), 29; steel erection, 25; steel fabrication, 172.7; tile wainscoting and floors, 30.9; waterproofing, 5; windows (kalamein), 50.7. The total increase in cost of building on the Eastern seaboard, therefore, including labor, is 30.7 per cent.

Minneapolis Company Publication Keeps Men in Government Service Posted.—The Minneapolis General Electric Company has begun publication of a four-page newspaper, *The Advance*, intended exclusively for employees and including especially those who are now in various cantonments and at the front. T. H. Kettle is editor.

Electrical Engineering in North Carolina State College.—Prof. William Hand Browne, Jr., professor of electrical engineering in the North Carolina State College of Agriculture and Engineering, West Raleigh, N. C., writes to the ELECTRICAL WORLD that the work in physics has been separated from that in electrical engineering and the department of physics is now under Prof. Charles M. Heck, who has been associate professor of physics at the college for some years.

Examination for Mechanical Draftsman.—The United States Civil Service Commission announces an open competitive examination for a male mechanical draftsman. Vacancies in the Panama Canal service or other branches of the service requiring similar qualifications will be filled from these examinations unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer or promotion. It is desired to secure the services of draftsmen capable of handling original design work on power plants, locomotives, steam shovels, etc. Mechanical draftsmen for the Panama Canal service are divided into two classes, depending upon qualifications. Competitors are urged to state clearly and completely their education and practical experience. Applicants should apply for Form 2118, stating the title of the examination desired, to the Civil Service Commission. Applications must be filed by Nov. 27, 1917.

Operating Conditions in General Gas & Electric Company.—President W. S. Barstow of the General Gas & Electric Company in a letter to stockholders says: "Substantial progress has been made in securing better rates, and in the solution of other operating problems. Financial needs have been taken care of so far as lies in our power, but in common with other similar companies, we face the new problem of inability to sell securities, and therefore are obliged to meet the necessary construction requirements through earnings or short-time financing. The resumption of full dividends on the cumulative preferred stock will depend upon two things: first, the restoration of normal financial conditions, so that securities may be sold to take care of the construction needs of the companies controlled, permitting distribution of earnings; second, improvement in the net earnings of the various properties controlled. Gross earnings are increasing, however, and new construction completed and under way as well as economies recently introduced will, we believe, result in an increase in net earnings."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Radio Club of America.—Dr. H. O. Taylor read a paper on "Thermocouples in Electrical Measuring Instruments," and Charles G. Kahant a paper on "Radio Frequency Instruments," at a meeting of the Radio Club of America in New York City on Oct. 27.

Institute of Radio Engineers.—"Some Aspects of Radio-Telephony in Japan" is the title of a paper presented by Eitaro Yokoyama, engineer of the Ministry of Communications, Tokio, Japan, at a meeting of the Institute of Radio Engineers held on Nov. 7 in New York City.

New Haven Section of the A. S. M. E.—The New Haven branch of the American Society of Mechanical Engineers will hold two sessions on Nov. 14. At the afternoon session papers will be read on the "Conservation of Fuel," and in the evening an address will be given by President Ira N. Hollis.

Council of the American Society of Mechanical Engineers.—On Nov. 16, in Chicago, the council of the American Society of Mechanical Engineers will meet. On this same date Major Peter J. Junkersfeld, member of the society, will address the Chicago Section on "Cantonment Construction."

San Francisco Electrical Development and Jovian League.—At the Oct. 24 meeting of the league Mrs. Robert J. Burdette made an address on "Food Conservation." The new officers of the league elected for the ensuing year are: President, Robert Sibley; vice-president, C. R. Fisher; second vice-president, H. C. Reid. W. S. Berry and E. O. Shreve were elected new members of the executive committee.

Schedule of Monthly Meetings of the Chicago Section, I. E. S.—The following is the schedule for the monthly meetings of the Chicago Section of the Illuminating Engineering Society for the coming season: Nov. 15, Prof. Francis C. Caldwin on "Preferred Proportions in Combining General and Localized Lighting"; Dec. 13, Arthur H. Ford on "Automobile Headlight Lamp Filaments and Measurements"; Jan. 17, W. A. Durgin on "Balancing the Light Beam"; Feb. 21, M. Luckiesh, on "The Lighting Art—Its Practice and Possibilities in Interiors"; March 21, Dr. Morton G. Lloyd on "The Relation of the Bureau of Standards to Illuminating Engineering"; April 18, Frederick J. Pearson on "Mistakes in Engineering as Applied to Illumination"; May 27, F. A. Vaughn on "Regulation of Street Series Lamps in Practice"; June 13, Charles A. Luther on "The Training of a Lighting Salesman."

Men of the Industry

Changes in Personnel and Position—Biographical Notes

H. A. Orr, manager for the Southern Public Utilities Company for the Anderson (S. C.) district, was elected president of the Southeastern Section of the National Electric Light Association at its recent annual meeting. Mr. Orr was born at Anderson, S. C., in December, 1876. He attended the Alabama Polytechnic Institute, taking a special course in electrical and mechanical engineering. His experience in the electrical field includes two years with the Stanley Electric Manufacturing Company, Pittsfield, Mass., in the testing and engineering department, and four years with the Anderson Water, Light & Power Company as engineer, after which he went with the General Electric Company in November, 1902, as manager of the new power department for the Atlanta (Ga.) district. There he did pioneer work in the electrification of cotton mills. In 1906 he left the General Electric Company to become president and treasurer of the Savannah River Power Company at Anderson, S. C., which company he organized and built. Three years later he was elected president and treasurer of the Anderson Water, Light & Power Company, and he remained at the head of these two companies until their purchase and consolidation with the Southern Public Utilities Company, when he assumed the duties of the position he now holds.

H. A. ORR

Leo F. Chambers has been appointed accountant for the Mankato (Minn.) division of the Northern States Power Company, succeeding O. T. McLean, resigned.

R. B. MacDonald, formerly general manager of the Fort Dodge (Iowa) Gas & Electric Company, has been made general manager of the People's Power Company, which operates in Moline, Rock Island, East Moline and surrounding towns.

George W. Milliken, local manager of the La Junta (Col.) division of the Arkansas Valley Railway, Light & Power Company, has been re-elected president of the La Junta Industrial Association, which office he has held for the last year.

William S. Richard has been appointed electrical engineer of the Fort Wayne & Northern Indiana Traction Company, succeeding E. S. Myers in that post.

J. F. Law of Portland, Ore., has been appointed district manager of the electric service company at Lewiston, Idaho, succeeding W. M. Wood, now at the Portland office.

L. J. Moore, formerly chief load dispatcher of the San Joaquin Light & Power Corporation, Fresno, Cal., has been promoted to electrical engineer for the company, succeeding A. S. Kalenborn, who has resigned.

A. S. Kalenborn has resigned as electrical engineer for the San Joaquin Light & Power Corporation to become electrical engineer and superintendent of power for the Cerro de Pasco Mining Company at Cerro de Pasco, Peru.

Claude C. Brown, formerly in the steam department of the Pacific Gas & Electric Company, has become power engineer for the Hawaiian Sugar Refinery Company at Crockett, Cal., in charge of steam and electric operation and construction.

Alfred Sweeney, assistant to the general manager of the Cumberland County Power & Light Company, Portland, Me., has been elected assistant general manager. Although this is only a slight change in title, Mr. Sweeney's authority is considerably increased. Mr. Sweeney was graduated from Pratt Institute, Brooklyn, N. Y., in 1904. He entered the employ of the Lambertville Heat, Light & Power Company, Lambertville, N. J., as electrician, and was sent from there to Florence, S. C., to hold a similar position with the Florence Electric Light Company, which was under the same control. Later he went to Norfolk, Va., to work in the track and power departments of the Norfolk & Portsmouth Traction Company, and in 1908 he entered the employ of the Lewiston, Augusta & Waterville Street Railway at Lewiston, Me. The following year he was made superintendent of track, and in 1911 assistant to the general manager. In 1912 the Lewiston, Augusta & Waterville Street Railway was purchased by the Cumberland County Power & Light Company of Portland, Me., and the companies, together with the Portland Railroad, came under common control under one management. Mr. Sweeney continued until the present time in the position of assistant to the general manager of the combined companies, which afterward included the York County Power Company and the Westbrook Electric Company.

H. W. Magruder, manager of the Liberal (Kan.) Light, Ice & Power Company, which was taken over by the Commonwealth Light & Power Company on Nov. 1, has been retained as manager under the new ownership. In addition to the Liberal property, he will have direct charge of the two Dalhart properties of the company. Mr. Magruder is a former president of the Kansas Public Service Association. Mr. Magruder was born at Ebina, Mo., in 1880 and received his education in the schools of Pratt, Kan. When a young man he went into the government railway mail service and later financed the electric plant at Liberal, of which he was made president. He has remained in that position ever since.

H. W. MAGRUDER

B. C. Condit, formerly chief engineer with the Southwestern Electric Company at Portland, Ore., is supervisor of electrical construction and equipment for the Crown-Willamette paper and pulp plant on the British Columbia coast.

Obituary

Oliver H. Hughes, chairman of the Ohio Public Utilities Commission, died in Columbus on Oct. 29 after an illness of several days. Mr. Hughes was appointed a member of the Ohio Railroad Commission in 1905, continuing as a member of its successor, the Public Utilities Commission, until 1915, when he resigned. Last January he was reappointed.

Guy Edward Mitchell, for the last three years manager of the Westfield (Mass.) municipal lighting plant, died on Oct. 18 in his home in Westfield at the age of forty-eight. He had been ill for about two weeks with pneumonia. Mr. Mitchell was born March 11, 1869, at Lowell, Mass. After attending the Lowell schools he went to the Massachusetts Institute of Technology and was graduated as a mechanical engineer in 1891. He had a long and varied experience as a draftsman and in construction and electrical work of many kinds.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

APPARENT SHORTAGE IN LAMPS ONLY TEMPORARY

Investigation Reveals Larger than Normal Stocks of Standard Sizes, but a Shortage in Automobile Lamps Running Up to 50 per Cent

Reports of a shortage in lamps in certain sections of the country, particularly in the New England States and the Pacific Northwest, have led to a careful investigation by the ELECTRICAL WORLD. It appears that there is no valid reason for this unless it is transportation difficulties, and if stocks in the hands of the trade have been exhausted, as advices state, it is only a temporary condition and will soon right itself. An inquiry at one of the larger lamp works brought out the statement that normal business is so heavy that no reserve stock in standard sizes can be accumulated. The demand for automobile lamps has increased abnormally, and on this type makers have not caught up with the arrearage.

On the Ford type—18-cp., 9-volt, 16½ bulb—it is impossible to fill requirements at the present time. There is an admitted shortage of 50 per cent, which, it was stated, rules the same with all the licensed manufacturers. On standard sizes of lamps there is also a 25 per cent increase in the specifications of jobbers and dealers over last year. In the New England territory and the Southwest the demand for lamps of 110 to 115 voltage, 25 and 40 watt, is such that the factory in question is unable to keep abreast of the sales. On these sizes it is not filling 100 per cent of orders—far from it. Normally for the last quarter shipments are 80 per cent, but 60 per cent is now about the average. The last quarter is always the busiest portion of the year. The stock of lamps on hand is on the whole the largest it ever has been and deliveries are being made in from three to four weeks. In some sizes deliveries can be made immediately, in others the delays vary, with carbon lamps on a four-month schedule.

Another manufacturer reports a very large stock in all its many warehouses in the standard sizes. One of its Eastern warehouses, in fact, asked that shipments be discontinued for a time as there was no more storage room available and the street was being utilized.

As a matter of fact, the lamp factories are in a strong position considering conditions, and stocks are relatively as ample as last year. Sign and high-voltage lamps are in liberal supply. The call for miniature lamps is so abnormal that orders are taken care of on percentage basis, and this condition will prevail for some time. The government has only requisitioned carbon miniatures, and no tungstens of any size are affected by the order. The prohibition of lead in the manufacture of either bulbs or lamps is in no way acknowledged at this plant. While the quantity of the metal in the glass is so small as to appear almost infinitesimal, the base of the lamp contains 80 per cent lead, and it was stated lamps cannot be made without it. Owing to the war some chemicals coming from Germany were shut off completely, but with lively work on the part of American chemists a domestic product was evolved, so that the glass-bulb factories will be independent of Europe for all future time.

If there is an apparent shortage in 25, 40, 50 and 60-watt lamps, it is ascribed to the acute pressure for these sizes at the army cantonments and naval bases. In the Pacific Northwest, owing to the enlarged shipyards and the increased number of lumber camps, in which the operations are not only greatly expanded but work is being carried on continuously, the stock of lamps in the hands of the local trade has doubtless been exhausted; but the manufacturers state that there is no reason for uneasiness. The shortage is temporary only. The method of keeping up stock with jobbers and dealers is such that any serious curtailments, as in these cases, are quickly looked after and the remedy applied.

In carbon lamps the situation is peculiar. It is held that there is no excuse for the employment of these lamps at all, even from an economic standpoint. When the cost of energy is low and the breakage is great, as in steel mills, mines, etc., possibly the carbon lamp may be used to advantage; otherwise the tungsten type should be recommended always by the dealer to the consumer. Nevertheless, the increase in the demand for carbons has been in a greater proportion than the regular average. In 1916 the increase over 1915 was 50 per cent, and 1917 shows another 50 per cent increase over 1916. The demand for carbon lamps is not considered a true increase. According to the same authority, there is no sound excuse for the employment of carbon lamps, excepting possibly in the cases mentioned. They should be replaced by tungstens.

It is held that, generally speaking, the trade is rather reluctant or indifferent to the advantages of tungsten lamps over carbons from an economical point of view. The public should be better informed and educated on this point, declares this manufacturer, and steps are being taken to overcome the wrong idea that tungsten lamps are more expensive to maintain or more delicate to handle than the carbons. There is a willingness to provide for additional productive capacity for the future, but none to use the plant expansion for turning out carbon lamps. This type is reckoned obsolete, with the smaller factories discontinuing their manufacture altogether, making tungsten lamps exclusively.

To sum up, outside of automobile lamps and headlights for automobiles, which have almost wholly superseded acetylene lamps, and on which the factories are unable to keep up with orders, even with the substantial increases of product, the supply is satisfactory. The trade is advised that in placing orders requirements should be anticipated as much as possible, at least three weeks in advance. Labor conditions, raw material and freight congestions should all be considered, in justice to the manufacturer. Agents, jobbers and dealers ought to know and should see that the records of the different types of lamps are properly assorted. So far no hoarding is reported, and the factories are prepared to prevent it if such an emergency arises.

MOVEMENT TO DISPENSE WITH TRADE HOLIDAY CARDS

The Savings Thus Effected Are to Be Devoted to Red Cross or Other Relief Funds Where They Will Be of Real Service

Even if not for business, certainly for patriotic reasons, in conserving the supply of materials and utilizing labor to the best advantage, many economies are finding their way into commerce. One of the latest, a movement started in Chicago, is to dispense with Christmas and New Year's business greetings this year.

Ordinarily several hundreds of thousands of dollars are spent each year by business houses and manufacturers in these seasonable greetings. The Chicago firms with which the idea originated of breaking the custom this year have decided to contribute the money that they would ordinarily spend in this manner to the Red Cross or other relief organizations where it will do real service.

The saving in labor and materials if a sufficient number of organizations take the matter up will be considerable in

addition to lightening the burden on the post office. In this latter case the requirements of the National Army have reduced the number of employees seriously. Any way in which the burden on this smaller force can be lessened, especially at a time when the holiday rush is on, will help the delivery of more important mail.

ELECTRICAL TOYS SELL BETTER THAN EVER NOW

An Advance in Price of from 33 to 60 per Cent, According to the Materials Used, Is the Announcement Made for 1918

Buying of electrical toys of various descriptions during the current season is in advance of that recorded in previous years. The larger orders were booked months ago and the goods delivered, and present orders are of the filling-in description. Manufacturers at the present time are busy preparing their new catalogs, which will be issued in time for the regular opening of the market in January. Road men are out in the trade looking for business on next year's account, and also to close the pre-holiday sales. An advance, effective Jan. 1, 1918, of from 33 per cent to 60 per cent, according to the material used in the various specialties, is also announced for the coming season. The electric range still continues a popular seller. Among the latest novelties is a steel-armored car, with revolving turret and the usual appurtenances of the real war article, operated either in connection with an electric train or singly.

Another arrival in the toy field is an improved, low-priced toy transformer, while a two-speed motor is a recent improvement in toy motors. Dolls, bears and animals with flashlight eyes are of many varieties and strong sellers. In fact, the expansion of the electric toy field is proceeding rapidly, and along lines of notable progression. Tree-lighting effects are normal as to sale and mechanical status. Deliveries are fairly good if shippers are favored with cars, and prices on staples will depend, for mechanical devices at least, on conditions in the metal market. Some firms have sufficient metal stock now on hand to fill their requirements for two years ahead.

METAL MARKET SITUATION

Changes Are Not Radical, with Aluminum a Shade Lower, Tin and Lead Advancing

No great difference has been noted in the metal market during the past week. Copper is officially at a nominal figure, but none can be had except at a stiff premium, and there are indications of a scarcity of the metal for several months ahead. Tin has gone up four points, aluminum is under last week's figure, and heavy lead is up.

The metal market still continues to cause uneasiness in every branch of the trade, with no definite dates for deliveries.

NEW YORK METAL MARKET PRICES

	Oct. 29	Nov. 5
Copper:	£ s d	£ s d
London, standard spot	110 0 0	110 0 0
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	29.00 to 31.00*	30.00 to 31.00
Lead, trust price	5.50	6.00
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter	19.00	19.00
Spelter, spot	7.80	7.67½
Tin, Straits	64.50	68.00
Aluminum, 98 to 99 per cent.	34.00 to 36.00	33.00 to 35.00

OLD METALS

Heavy copper and wire	22.00 to 22.50	21.50 to 22.50
Brass, heavy	14.00 to 16.00	14.00 to 16.00
Brass, light	10.50 to 11.00	10.50 to 11.00
Lead, heavy	4.75 to 4.87½	5.00 to 5.25
Zinc, old scrap	5.00 to 5.50	5.00 to 5.50

*Nominal.

THE WEEK IN TRADE

LABOR disturbances, particularly in the Northwest, are probably of the greatest significance at the present time. With winter approaching fast, labor unrest can be expected to grow because domestic expenses become heavier. In the East there have been many indications of a growing uneasiness on the part of labor.

The government's exercise of priority rights is being experienced in almost all lines, and consequently deliveries on private contracts are more uncertain than they were. In addition, the transportation facilities of the country are becoming taxed to the point where congestion again prevails on shipments in certain directions.

Prices generally are stable and collections and credits good.

NEW YORK

Transportation problems are becoming more and more pressing, and as a result deliveries to the Eastern seaboard are becoming worse. In certain lines, particularly conduit, this situation is somewhat alarming. In certain of the building lines relief is being sought through full-car shipments. Where there is not enough to fill a car co-operation is sought among non-competing lines going to the same place. There is no evidence of a general adoption of this plan as yet by the electrical industry.

Demand, except for building materials, is being maintained, and prices show no change. Credits are receiving more than usual scrutiny, although collections are large.

CONDUIT.—For a year deliveries of interior conduit have been an uncertain quantity, if not altogether negligible, if the reports of the sales offices in this territory may be followed. It is emphatically stated that not only is conduit scarce but none is to be had, government embargoes blocking deliveries. Prices are as high as they can go without upsetting all trade buying.

MOTORS.—In sizes up to 25 hp. deliveries are often made out of stock, with the demand falling off. The larger sizes are still far behind, and the date of probable shipment is a matter of negotiation in all contracts for apparatus of this size. The demand for motors of all sizes has varied within the last year or more, different industrial groups coming into the market from time to time with their requirements. Further changes in this respect are being figured on for the future, so much so that houses in this line describe their position as radically different from that normally occupied by them.

COLLECTIONS AND CREDITS.—Jobbers' collections are reported as slow on contractors' accounts. This is owing to the uncertainty of merchandise deliveries. As contractors cannot get their money until the "job" is completed, the hold-up of an order for special requirements to meet the situation acts as a natural deterrent in liquidating bills. The smaller jobbers are charged with speculating on market possibilities in certain lines, and being woefully disappointed by an unexpected drop in prices, and are therefore not in a happy frame of mind regarding their indebtedness. The Moral Risk Club, a membership of eleven jobbers in New York City, acts as an informal clearance house for collections and credits, and the reciprocal exchange of information is both interesting and valuable to its members. Among the manufacturers collections are firm, with credits reckoned on anything but an inflated basis.

REFLECTORS.—There is no change in prices. Stocks in the hands of distributers and jobbing houses vary according to the foresight of these houses. Deliveries are as good as could be expected, all factors being considered.

FREIGHTS.—Not only are freights causing embarrassments for every branch of the trade, but the performances of the express companies are no better, if they are not worse. Deliveries to dealers and contractors cannot be promised on a guaranteed basis, and conditions are expected to get worse rather than better owing to the anticipated military commandeering of transportation facilities.

FUSES.—With jobbers stock is reported as satisfactory, and deliveries are of a fair average. This is occasioned by the factories catching up with orders. Sales are more or less subject to the pressure of competition, with a trade increase of fully 50 per cent over last year at this time. Top prices prevail, with no relief in sight.

HOLLOW WARE.—Percolators, chafing dishes, etc., are not in such full supply as could be wished. Deliveries are back thirty days, with prices stationary. No change is anticipated.

LIGHT FIXTURES.—A tendency to advance prices is acknowledged, though no recent change has occurred. This is caused by the uneasiness observable in the metal market. Deliveries from factory to jobbers are not complained of especially, but pending labor troubles are making for uncertain shipping and price conditions.

CHICAGO

There is reassurance in the monthly review of business for November issued by the National Bank of the Republic, Chicago, because it indicates a belief that business in general has come through the period of uncertainty.

One thing that is noticeable among the jobbers is that stocks which heretofore were maintained above normal are now characterized as "just ordinary." All speculative holdings have been sold. There is not much change in the volume of business. In some quarters a slight falling off for the week was noted. Prices are very steady and have been for two weeks. Credits and collections are about normal.

SHIPMENTS.—No appreciable trouble has been experienced by trade in getting shipments from factories where the factories can ship. Railroad embargoes have not interfered.

SOCKETS.—Ordinary stocks are being carried by jobbers. The shortage reported in the East has not been felt in the Middle West as yet, possibly owing to the fact that jobbers have not been buying many sockets lately.

WIRING DEVICES.—Of this class of supplies conduit continues to be the feature. It is very difficult to get because of government activities.

LAMPS.—The chronic delivery situation still prevails to some extent, although 25, 40 and 60-watt sizes are easing up somewhat. Surprise is expressed that price advances have not already been made and the fact that new contract forms are out is taken to mean that "there is something in the air."

COPPER WIRE.—Most jobbers are selling rubber-covered wire on a 34-cent or 35-cent base. The market has apparently been swinging between 34 cents and 37 cents, but when discounts are considered it is shown that wire is pretty steady around 34 cents.

MOTORS.—When present stocks, of which there are a few, are depleted the Chicago motor market bids fair to get into a worse state than it is at present. Deliveries from factories run from two months to refusal to quote.

WASHING MACHINES AND VACUUM CLEANERS.—While sales are holding up well locally the impression prevails that "time payment appliances" are not as popular as they were a few months ago.

HEATING DEVICES AND HOLLOW WARE.—Christmas trade is picking up. The snow in Chicago made buyers think. In two weeks some jobbers look to see Christmas buying by dealers in full swing.

BOSTON

Business activity continues practically unabated in the electrical trade. Jobbers are very busy and report a healthy trade in appliances. Motors are still in large demand, and prices show no change, barring variations affected by delivery conditions. Labor is getting scarcer and some disturbing demands are being received here and there. The production of war craft has been impeded by a strike still in progress at the Fore River plant, and there is no change in the strike situation in the New England repair and distributing plant of the Western Electric Company. The State Board of Arbitration issued a finding against the company a few days ago relative to the cause of the disturbance, but as yet the company has made no public statement as to its case. The lamp situation, for the present, appears to be getting no worse. A slight increase in building operations is noted, but not enough to affect the electrical market to any great extent. Collections are about the same as last week and deliveries are, if anything, poorer. Contractors are feeling the adverse effect of high wages paid for government and related work. One prominent contracting engineer said this week that the government should fix the price of labor as well as the price of materials, thus stabilizing the man market.

APPLIANCES.—A brisk trade is reported, following a slight lull three or four weeks ago. One central station has just sold $7,000 in vacuum cleaners, the campaign covering but a few weeks. Continued warm weather has slowed down the demand for electric radiators to a point where undersales are reported in some quarters. Washing machines are moving well and there is a noticeable industrial demand for flashlights. One of the largest central stations reports that the advances of the year in high-class percolators and chafing dishes have, temporarily at least, been reflected in a decreased volume of sales. Fixtures are moving rather slowly, owing in part to the frequent turn-over in illuminating styles for commercial installations. The outlook is good for a substantial business in portable lamps, this trade having begun to develop materially.

MOTORS.—Eight months' delivery is still quoted on motors of over 100-hp. rating by one large dealer, and in general the motor situation shows little change. The government is exerting its priority powers without compunction. On a recent order covering nearly 800 hp. in motor units for government service the first delivery will be made in two months, and thereafter at least one motor per week will be shipped. The demand is too great to allow much factory stock accumulation. No price changes are in sight.

AUTOMATIC TIME SWITCHES.—Demand is increasing and deliveries are lengthening somewhat. Popular appreciation of the value and reliability of this class of equipment as a labor-saving device is growing.

ELECTRIC RANGES.—Substantial orders are being handled for industrial plant service. Naval requirements are very pressing. Deliveries are fairly good on standard equipment in stock sizes.

LAMPS.—At the moment the supply of lamps is fairly plentiful. It cannot be denied that there is a shortage in some makes and sizes, but the manufacturers are alive to the situation and are doing much to supply the demand on a fairly steady basis. Hoarding of lamps is under the ban at present. The prospects are that the shortage will increase before winter is over. In some cases fair-sized local stocks are being manipulated, at least temporarily.

GLASSWARE.—Long deliveries and uncertain shipments are reported on glassware of highest grade from foreign makers.

WIRE AND CABLE.—The government is said to be taking about 85 to 90 per cent of the wire production of the country. This naturally is disorganizing deliveries, and customers not occupied immediately in war service are seriously handicapped. There is a general disposition to recognize the justice of the government's needs. The wire market is a little soft, on account of the federal price fixation, but little opportunity exists to take advantage of this situation, on account of the uncertainty of deliveries.

MOTOR-DRIVEN BLOWERS.—The industrial demand is about 100 per cent above normal and the government demand most vigorous.

COAL-HANDLING MACHINERY.—Inquiries are numerous, deliveries fair and prices reasonably stable.

ATLANTA

The number of building permits shows a substantial increase over last week for the Southeastern section. Residence building in Atlanta also is showing a marked improvement. The construction of apartment houses has

taken another spurt and a number of high-class structures are contemplated. Activity in apartment house building this year has increased the volume of fixture sales materially, and the outlook appears very good for this demand to remain steady for some time.

Building operations in Atlanta during the past year have steadily increased as reflected in the report from the building inspector's office setting forth a comparison of the valuation of building permits issued for the first ten months this year and those for the same period of 1916. The permits thus far issued this year list building valuations for work already under way at $4,478,139, compared to $3,159,450 for the first ten months last year, the increase thus being $1,318,689. A number of new buildings that have been formally approved by the building inspector and which have just started have not been listed in the permit valuation, and for this reason permits for the month of October do not show up so well as they should. But the heavy increase in total valuation for the year as a whole is the indication that promotes optimism in building and electrical circles of the city.

STAMPED-STEEL BOXES.—Demand has been above normal, with probably the exception of Atlanta, where these boxes always have to be used on nearly all jobs in the city limits where work is being done under city inspection. One manufacturer is offering lots at an approximate shade of 5 per cent under the market.

RIGID CONDUIT.—The market is comparatively steady for both the white and black. Shipments are being made in four weeks, which indicates a slight improvement for this section.

TEXTILE APPARATUS. — The volume of business in this line has shown a considerable decrease lately compared with the earlier months of this year. This condition is to be expected, however, as a number of underlying conditions affect this class of apparatus. The main factor is that the large hydroelectric companies in the Southeast supplying energy in large blocks have about reached the point where all surplus energy is contracted for, and they are unable to take on any more business at this time. Then, too, extensions of considerable distances are very costly at present, while a year ago money was much easier and labor and material more reasonable. Furthermore, no new mills are being built, and the shipment on turbines and motors is very discouraging, not to mention the difficulty of securing coal, regardless of price.

ARMORED-STEEL CONDUCTOR.—More activity is noted in this class of goods for the past week. The price remains firm and stocks are holding up well.

TRANSFORMERS.—One manufacturer reports an advance of 10 per cent on the 2300-volt distributing type up to 200 kva. This advance will not affect present transformer contracts, however. Manufacturers also report an improvement in shipments on ratings up to 100 kva.

SEATTLE

The sales of electrical equipment and machinery to shipyards and allied industries show a slight increase over last week, due to the active resumption of work following strikes in both steel and wooden concerns. Sales were about the same in volume as during the weeks preceding the strike.

Sewing machines, washing machines and heaters are moving particularly well. Dealers have planned for and expect a heavy holiday business in practical energy-consuming devices which relieve the labor of the home.

Automobile lamps are moving well, but stocks are low. Floodlamp sales are increasing, and stocks are in a satisfactory condition.

The sales of farm lighting outfits exceed the expectations of the most optimistic, and results of the recent campaign are not yet completely known.

Prices show no noticeable changes. Stocks along some very important lines are exceedingly low, particularly for ¾-in. conduit, the kind the government especially needs; lamps, in the larger sizes particularly; rubber-covered wire and the larger-size motors. These shortages are expected to continue.

The car situation in Washington is reported a little better, on account of combined shipments, cars being loaded to capacity. Through the efforts of the railroads and commissions the Oregon situation is reported about the same, with no decided improvement indicated.

Building operations in the Northwest, long dormant, have received a slight impetus during the week with the announcement of the immediate construction of seven cantonment buildings at the three forts at the mouth of the Columbia River in Oregon, and 150 residences in Charleston, Wash., for the employees at the Bremerton Navy Yard. Big construction, however, in the cities of the Northwest is at a standstill. The local labor situation is chaotic as never before in the history of this section.

More than ordinary discretion is being exercised in placing credits. Especially is this true with small wooden shipbuilding concerns which give the slightest indications of improper or inadequate financing. Because of the scarcity of materials, particularly those used by shipyards—namely, conduit, larger sizes of wire, lamps, motors and the like—dealers naturally prefer and elect to do business with firms of unquestioned credit. There is no necessity for dealers to take chances when the risk is recognized. The placing of credits with the smaller machine shops, lumber mills and like industrial enterprises is being scrutinized closely. A slight preference is being shown establishments which are not dependent upon government contracts for their being and successful operation. Collections are easy and satisfactory, with the exception of government accounts, which are necessarily more or less slow because of routine. However, good government contracts, provided that the concerns have ample financial backing, entitle their holders to unlimited credit.

A strike of approximately 1300 union electrical workers and telephone operators in the employ of the Pacific Telephone & Telegraph Company in Seattle for increased wages and recognition of the operators' union was declared Oct. 31 at midnight.

SAN FRANCISCO

The inactivity in building construction has diverted effort into new fields. The attention of contractors, and to a certain extent of dealers as well, is just now upon the industrial lighting field, which is the most active. Night shifts are being put on in many plants and much improvement of the lighting systems has resulted. The demand for floodlighting equipment is also heavy, and the large number of factories increasing their output creates a steadily growing business in transformers, motors, wire, conduits, sockets, outlets, switches, etc.

The car shortage, which has grown daily more acute in California, has reached a stage where it is bound to hurt the electrical trade, not only in delaying shipments, but because of losses that depress business conditions generally. It is reported, for example, that in one community 2000 carloads of table grapes spoiled this year because freight cars were not available for getting them to market.

CREDITS AND COLLECTIONS.—With the contractors finding employment on industrial work and the rural fields in prosperous condition, collections are generally in a very satisfactory condition. There have been no failures to shake confidence, and credits are holding up even better than had been expected.

FLASHLIGHTS.—An unusually heavy demand for flashlights has been notable in recent weeks. It is believed that this is largely due to buying for men who are going into the National Army training camps.

STORAGE BATTERIES.—The demand for batteries is growing rapidly. Orders are coming from builders of tractors for government use, from shipbuilding firms and from a large number of automobile owners who want a better grade of battery than that supplied on some new cars.

CONDUIT AND SOCKETS.—Stocks are fair and an active demand is being handled satisfactorily. Delivery is quoted for ninety days.

WIRE.—Stocks of weatherproof are still low, but the condition is improving somewhat in most other lines.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List, per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 Solid.
Less than coil .....+10% to list net
Coil to 1000 ft.....—10% to $59.17

No. 12 Solid.
Less than coil .....+10% to list net
Coil to 1000 ft.....—10% to $68.87

Twin-Conductor

No. 14 Solid.
Less than coil .....List net to $105.00
Coil to 1000 ft.....$70.00 to 10%

No. 12 Solid.
Less than coil .....List net
Coil to 1000 ft.....10% to $130.95

DISCOUNT—CHICAGO

Single-Conductor

Less than coil.....+10%
Coil to 1000 ft.....—10%

Twin-Conductor

Less than coil.....+10%
Coil to 1000 ft.....—10%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....10% to list net
1/5 to std. pkg.....15% to 20%
Std. pkg. .....28% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....+20% to 12%
1/5 to std. pkg.....List to 20%
Std. pkg. .....28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.31 to .32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 30	.35	.35
50 to barrel	.31 to .3175	.32 to .3275
Barrel lots	.28 to .2875	.29 to .2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. Per Coil	List, Per 100 Ft.
5/16	250	$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25–50	35.00
2	25–50	45.00
2 1/2	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.	$75.00	$63.75 to $69.75
3/8-in. d. stp.	75.00 to 82.50	68.25 to 75.00
1/2-in. s. stp.	100.00	85.00 to 93.00
1/2-in. d. stp.	100.00 to 110.00	91.00 to 100.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 100 Ft.
3/8-in. single strip	$75.00	$63.75
3/8-in. double strip	78.75	71.25- 71.27
1/2-in. single strip	100.00	85.00
1/2-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32	$0.05 1/2	1	$0.25
1/4	.06	1 1/4	.33
5/16	.09	1 1/2	.40
3/8	.12	1 3/4	.47
7/16	.15	2	.55
1/2	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—		
$25.00-$55.00	$20.50-$24.75	$20.00-$22.00
1/4-in.—		
$28.00-$60.00	$22.50-$27.00	$22.00-$24.00

NET PRICE 1000 FT.—CHICAGO

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—		
$36.69-$55.00	$27.50	$24.75
1/4-in.—		
$40.00-$60.00	$30.00	$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4	$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37
2 1/2	.58 1/2
3	.76 1/2

	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.60
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	4% to 6%	7% to 9%
2500 to 5000 lb.	6% to 8%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	3.4% to 4.8%	6.4% to 6.8%
2500-5000 lb.	6.4% to 7.8%	8.4% to 9.8%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price .....$5.00 to $6.00
Discount .....25% to 30%

CHICAGO

List .....$5.00 to $6.00
Discount .....25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....28%
1/5 to std. pkg.....38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....28%
1/5 to std. pkg.....38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK.

	Per 100 Net
Less than 1/5 std. pkg.	$5.00 to $5.75
1/5 to std. pkg.	4.50

Standard package, 500. List, each, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, each, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.50
25-watt—G 25	50	.50
40-watt—G 25	50	.50
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.72
Round bulbs, 4⅝ in., frosted:		
100-watt—G 35	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $33.98
Coil to 1000 ft.	25.50 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$36.24 to $36.56
Coil to 1000 ft.	27.18 to 27.42

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	$20.00 to $29.00

CHICAGO

Net per 100	$19.25 to $25.75

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, AX, 1½, 4 S	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S. 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25%	32%
$10.00 to $50.00 list	42%	40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	37%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$15.00 to $38.00
1/5 to std. pkg.	13.60 to 19.00

Standard package, 2200 List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80 to $20.54
1/5 to std. pkg.	14.80 to 19.24

Standard package, 2200 List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
	5½ N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.	$20.00 to $29.00	$23.20 to $30.75
1/5 to std. pkg.	13.50 to 15.60	18.70 to 24.20

CHICAGO

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
	5½ N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.	$11.85	$30.75
1/5 to std. pkg.	11.10 to 11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std pkg.	Net
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. R. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade	Low Grade
Less than $10 list	List net to + 5%	5% to 10%
$10 to $25 list	Net to 11%	10% to 16%
$25 to $50 list	14% to 15%	14% to 25%

DISCOUNT—CHICAGO

	High Grade	Low Grade
Less than $10 list	+5%	5%
$10 to $25 list	11%	16%
$25 to $50 list	14%	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to net
1/5 to std. pkg.	Net to 15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List, Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List	Net
$2.00 to $10.00 list	10% to 20%	5% to 10%
$10.00 to $50.00 list	20% to 30%	15% to 20%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25% to 50%	20% to 40%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$5.00 to $7.50
Discount	25% to 30%

CHICAGO

List price	$5.00 to $6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

No. 18, less than full spools.	$0.44¼ to $0.65
No. 18, full spools.	0.43¼ to 0.55

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	$0.57½ to $0.65
No. 18, full spools.	0.50½ to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11.	$15.00-$18.00	$13.00-$14.00	$11.25-$12.00
12.	23.25- 27.09	21.30- 23.22	19.35- 20.85
10.	32.40- 37.80	29.70- 32.40	27.00- 29.25
8.	45.70- 53.34	41.90- 45.73	38.00- 41.38
6.	72.40- 84.42	66.35- 72.40	60.30- 65.50

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$18.00	$13.50	$12.00
12	25.21-27.37	21.30-27.37	17.40-23.46
10	35.29-38.25	29.82-32.72	24.35-30.60
8	49.91-54.27	42.18-46.43	34.45-43.42
6	78.95-92.61	60.85-79.23	45.76-74.09

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$35.25 to $40.00
25 to 50 lb.	35.25 to 39.00
50 to 100 lb.	34.25 to 38.00

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$40.00 to $40.50
25 to 50 lb.	39.00 to 39.50
50 to 100 lb.	38.00 to 38.50

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Colored Lamp Shade

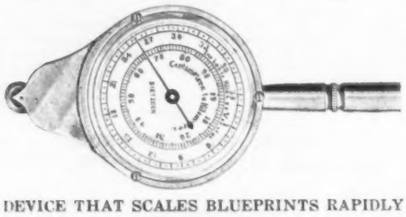
The Pittsburgh (Pa.) Lamp, Brass & Glass Company is manufacturing a red, white and blue lamp shade for use with the usual types of electric light fixtures. The shade is 5 in. (12.7 cm.) high and measures 4 in. (10 cm.) in diameter at the base. In addition to private residence trade, this shade is useful for banks, Red Cross booths, enlistment offices and military outfitting departments of stores.

Firebrick from Coal Ashes

Brick made from coal ashes, suitable to substitute for fireclay brick, building brick, etc., is possible, so it is claimed, by a new process which has recently been developed by the Wagner Fire Brick Company, Scranton, Pa. This company points out that tests have shown that these bricks placed in service and subjected to 3000 deg. Fahr. (1650 deg. C.) gave three times the service that the common firebrick gave. The fusion point is from 2600 deg. to 3250 deg. Fahr. (1427 deg. to 1788 deg. C.), depending on character of binder used; crushing strength, 130 lb. and over to the square inch (9.1 kg. per sq. cm.), with a 22.5 per cent porosity.

Measuring Device for Estimating

The rotary measuring instrument or "map measure" which is illustrated herewith is valuable in rapidly scaling blueprints for estimating purposes. It makes possible a direct reading in inches of the distance between lighting outlets and distribution centers in any desired course. This instrument, which is durably made and well finished, is manufactured by the Eugene Deitzgen Company of Chicago. The use of the instrument is simple. The tracer wheel is placed at one end of the line

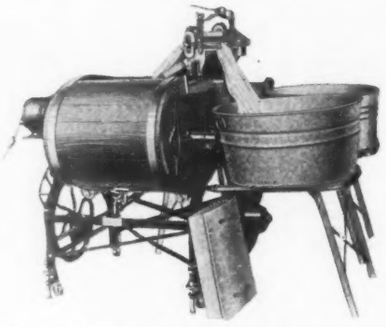


DEVICE THAT SCALES BLUEPRINTS RAPIDLY

to be measured and is then rolled to the other end of the course. The reading on the dial represents distance in inches between the two points. The actual length can be readily obtained from the scale of the drawing. An inner scale is provided on the instrument, graduated in centimeters, thus enabling inches to be quickly converted into centimeters and vice versa.

Washing Machine

The Buckeye Churn Company of Sidney, Ohio, is manufacturing a washing machine which it claims to be the first ever constructed to wash clothes by employing the principle of surface tension. The tub contains no corrugations or rubbing devices and is entirely smooth inside. The machine depends for its cleaning qualities upon the hammer stroke of the elliptical tub, which breaks up the soapy water and drives it through the fabric of the clothes. One type which the company makes has a capacity of ten sheets or their equivalent and operates at a speed of from forty-eight to fifty-five strokes per minute. The tub is made of fir staves held together by tank lugs which are adjustable. The metal lid



FEATURE IS THE HAMMER STROKE OF THE ELLIPTICAL TUB

is steam-tight. The frame is made of cast iron and is mounted on casters which may be lifted from the floor by adjustable screws that permit leveling on an uneven surface. All gears are inclosed and run in oil. The wringer is of the swinging reversible transmission type. The machine is driven by a 1/6-hp. Invincible washing-machine motor. The Sidney Electric Company, Sidney, Ohio, is the distributer.

Regulating Socket

A socket carrying an Edison base and having sufficient capacity to regulate small-size 110-volt motors is now being manufactured by the Wirt Company, Germantown, Philadelphia. Four steps are provided, ranging from 0.3 amp. to 0.6 amp. Either gunmetal or nickel finish may be furnished. A milled fiber ring mounted on the socket provides an easy control of the resistance.

Double-Disk Stove

Stoves that are very durable for lunch rooms, schools, hospital diet kitchens and many other places where quick work is desired have been brought out by the Simplex Electric Heating Company of Cambridge, Mass. These stoves contain the company's new type of inclosed-coil heating units which

WILL STAND CONTINUOUS USE ON HIGH HEAT

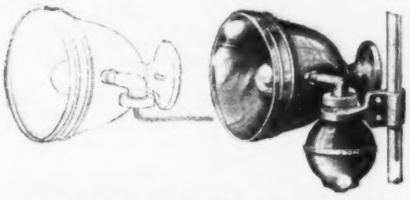
have enabled the makers to produce many types of heating and cooking appliances that will stand very severe usage, it is claimed. The tops of these stoves may become red hot when used continuously on high heat and the elements will not burn out when used this way continually. Each stove is 8 in. (20.3 cm.) in diameter and has three heats, with a maximum wattage of 1200.

Rotary Automatic Starters for Motors

Rotary starters for the automatic acceleration of single-phase polyphase and direct-current motors are made by the Machine Products Company of St. Louis, Mo. This type of starter is inclosed in a substantial housing screwed to the ends of the motor and carrying a set of brushes. It consists of a plate mounted upon the motor shaft and rotating within the housing. Upon this plate are carried a set of slip rings, a set of laminated contacts, a centrifugally operated mechanism and a ventilated type of resistance. The resistance element is always in series with the motor circuit, the current being carried to the starters through the medium of the brushes and slip rings. Upon closing the motor switch the plate revolves with the armature and the weights are gradually thrown outward by centrifugal force and in direct proportion to the increasing speed of the motor. These weights actuate the contact arm, and the resistance is cut out of the motor circuit as the armature attains full speed. A device is provided which prevents the return of the contact arm should the motor speed decrease owing to load or decreased voltage, but which allows its return when the motor has come to a standstill.

Electric Spotlights for Motor Cars

The latest development in the line of automobile electric spotlights manufactured by the Anderson Electric Specialty Company, 562 West Van Buren Street, Chicago, is a lamp the frame of which is designed to clamp to the windshield of the motor car. An automatic



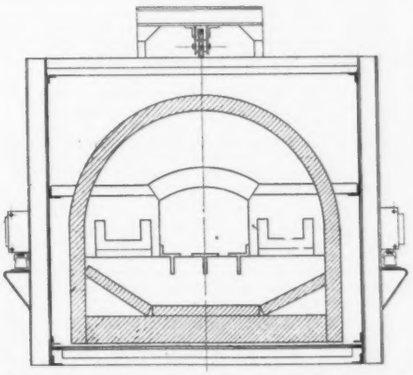
DESIGNED TO CLAMP ON WINDSHIELD

cord reel carrying 12 ft. (3.7 m.) of extension cord is used. By loosening a knurled nut the lamp can be removed for inspection of the motor car, thus converting it into a portable light. When in place the lamp acts as a dirigible searchlight within easy reach of the driver's hand.

Electric Furnaces

Electric furnaces of the resistor type which differ from the arc-type melting furnaces for melting steel in the same general way that the incandescent lamp differs from the arc lamp are made by the Electric Furnace Company of America, Alliance, Ohio. In general detail the furnaces are inclosed in a steel shell having an inner chamber wall of firebrick, the space between this brick wall and the steel chamber being filled with heat-insulating material.

Inside the furnace chamber formed by the firebrick walls are placed two troughs, one on each side of the furnace. These troughs are composed of highly refractory carbide. At the ends of this trough are carbon or graphite electrodes extending from the end of the trough inside the furnace through the wall of the furnace to the outside,



SECTIONAL VIEW OF RESISTOR TYPE OF FURNACE

where each is connected to its electric cable and to the electric service lines through the special transformer always supplied with the furnace.

The trough just referred to is filled with broken carbon or graphite from electrode to electrode, and when the current is on electricity flows from electrode to electrode through this broken carbon bed, which becomes incandescent through its entire length in the same manner as an incandescent lamp filament or wire. The heat from this huge filament is radiated to the roof of the furnace, and then back onto the hearth of the furnace itself and to the material to be heated. This type of furnace is known as the Baily furnace.

Eight-Paneled Globe for Ornamental Units

Specially designed for residential and park lighting service, an ornamental Novalux fixture has been announced by the General Electric Company of Schenectady, N. Y., having an eight-paneled globe of stippled glass and equipped with a new refractor and reflector. The lamp interior has two important improvements. The bell-

EQUIPPED WITH REFRACTOR AND REFLECTOR

shaped Holophane refractor collects all the upward light and redirects it at the most efficient angle, it is said. A cone-shaped reflector saves the downward rays, otherwise lost, and transmits them to the street.

The eight sections of the globe are all of stippled glass designed to diffuse the light over the greatest possible efficient area and to give the lamp a luminous glow which makes it especially ornamental even in the daytime.

Quick-Break Safety Switch

In the inclosed switch known as type "DF" now being manufactured by the V. V. Fittings Company, Philadelphia, both "quick-made" and "quick-break" features are incorporated. The fuse compartment cannot be opened while the switch is in, and an interlocking device prevents closing the switch while the fuse chamber is open. Heavy sheet steel is used in the box construction. Side openings are provided to allow room for wiring. The switch is made in sizes for 250, 500 and 600 volts and from 30 amp. to 1000 amp.

Waterproof Telephone

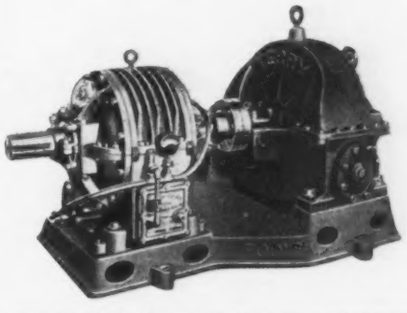
The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., has developed an ironclad and waterproof telephone for service in mines or in other places where the working parts of a telephone instrument must be protected against unusual operating conditions. All parts of this instrument are inclosed within a cast-iron box. This box is provided with double doors which give either partial or complete access to the interior apparatus as desired. One of the features of this instrument pointed out is the spring lock on the outer door, which is arranged so that it can be opened with the use of but one hand by means of a push-button latch.

Semi-Indirect Lighting Fixtures

There is an indirect lighting bowl now being placed on the market by the Superior Brass & Fixture Company, 316 Jackson Boulevard, Chicago, Ill., which is provided with a removable ventilator so that the interior of the bowl may be cleaned in place. Specially designed cleaning brushes are supplied with each outfit. The ventilator, it is pointed out, prevents lamp breakage by keeping the source of light cool in a circulation of air. Specially treated snow-white opalescent glass is used in all of the sunny indirect bowls which are designed for use in connection with nitrogen-filled lamps.

Turbine Speed Reducing Gear

In the accompanying illustration is shown a 100-hp. turbo-gear directly connected to a Terry turbine, reducing the turbine speed from 3600 to 440 r.p.m., which is the speed of the driven unit, in this case a blower. Two of the most noticeable features pointed out in connection with this oufit are its compact and symmetrical appearance and the absence of offset shafts, the driving and driven shafts of the turbo-



ABSENCE OF OFFSET SHAFTS IS FEATURE OF GEAR

gear being in the same straight line. These features result in a considerable saving of floor space as well as permitting a better grouping of the machines. The turbo-gear is manufactured by the Poole Engineering & Machine Company of Baltimore, Md.

Trade Notes

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., will build a new one-story and basement brick substation. The structure will be about 48 ft. by 100 ft. Plans have been prepared.

THE YOUNGSTOWN (OHIO) SHEET & TUBE COMPANY has opened a branch office in the Munsey Building, Washington, D. C. W. B. Blowers will be in charge as district sales agent, assisted by H. E. Richardson, who has been transferred from the Philadelphia office.

THE ELECTRIC FURNACE CONSTRUCTION COMPANY, Philadelphia, announces that Frank Wharton Brooke, formerly metallurgist of Crowleys, Detroit, Mich., and at the Ludham Steel Works, and G. W. Ketter, who has been directing and superintending electric furnaces for years, have joined its staff.

THE PENNSYLVANIA RAILROAD COMPANY, in "Loss and Damage, Bulletin No. 7," calls for co-operation from shippers to save waste. The company estimates that more than $2,000,000 worth of freight every year is destroyed, and the purpose of the bulletin is to urge shippers to pack their goods properly and to use containers that are strong enough to stand transportation.

R. P. PAYNE and F. N. Wilson began on Nov. 1 to cover for the Northwestern Electric Equipment Company, St. Paul, the territory in Minnesota formerly looked after by A. M. Baldwin, Jr. On that date Mr. Baldwin became business district manager of the company's new branch warehouse and sales office at Duluth, as mentioned in the ELECTRICAL WORLD of Oct. 27. In Montana and North Dakota, with some few exceptions, the trade will be divided between W. G. Hosking and J. S. Eaton. The exceptions will be cared for by special representatives from the main office.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., has of late added considerably to its manufacturing facilities. President E. M. Herr recently made an announcement concerning the company's growth from which the following is taken: "In the village of Turtle Creek and near our East Pittsburgh works a thoroughly equipped and highly efficient copper-refining and copper-manufacturing plant has been installed, enabling the company to make a large part of the switchboard, commutator and other manufactured copper formerly purchased. Adjacent to this copper mill a complete metal-reclamation plant has been built in which all the more expensive metal scrap from our various factories is worked over and reclaimed. The growth in the use of micarta products has necessitated a rapid expansion in the manufacturing facilities for this product, cared for by additions to the shop where this material is fabricated at our East Pittsburgh works. The rapid increase in transformer business has made necessary the erection of a building for the manufacture of tanks for large transformers and built-up cases for all kinds and sizes of transformers. This shop is located at Trafford immediately adjacent to the foundry of the Westinghouse Machine Company—6 miles from East Pittsburgh and connected with it by the Westinghouse Interworks Railway. In order to provide for the rapid increase in business of fractional horsepower motors, an additional story has been added to the building at East Pittsburgh in which these motors are manufactured, which, together with machinery added in other parts of this building, has increased its capacity from 5000 to 10,000 motors per month. In order to do the necessary research development work required by the many activities of the company, a new research building, with complete modern equipment, was erected and is in full operation, almost a mile from the East Pittsburgh works, at a point where cleanliness and freedom from vibration are completely secured. The most important recent addition to our manufacturing facilities has been the plant now building at Essington, Pa. Contracts have been let and construction is rapidly progressing on two large machine shops, an adjoining erecting shop, power house, forge shop, foundry, pattern shop and pattern storage building. This entire plant will be finished and fully equipped with machinery before the end of the year and will add 820,000 sq. ft. to our manufacturing floor space. This plant, it will be seen, will be a new center of growth for our manufacturing activities. In the immediate future, owing to the needs of our government for engines and engine-room equipment for its large shipbuilding program, both this new plant at Essington and a portion of the machine works at East Pittsburgh will be devoted to the manuacture of steam turbines, condensers and Westinghouse high power transmission gearing. Ultimately, however, the steam-turbine manufacture will all be carried on at Essington, the machine works at East Pittsburgh being then occupied by the necessary expansion of our electrical business."

Trade Publications

STORAGE BATTERIES. — The General Storage Battery Company of St. Louis has prepared a booklet descriptive of its storage batteries.

A. S. M. E. PUBLICATIONS. — The American Society of Mechanical Engineers has prepared a leaflet descriptive of important publications it has recently issued.

PORTABLE ELEVATOR.—Bulletin 42, descriptive of how to use the revolvator for piling work, has been prepared by the New York Revolving Portable Elevator Company of Jersey City, N. Y.

FANS.—H. Boker & Company, Inc., of New York City, have prepared a booklet in which is given a table showing the cost per hour of energy consumed at rates from 1 cent to 10 cents per kilowatt-hour.

ELECTRICAL SPECIALTIES. — The Chelten Electric Company of Philadelphia has prepared its 1918 catalog descriptive of its wiring devices. This catalog has been prepared with the intention of answering any questions the prospective purchaser may ask.

ELECTRICAL MACHINERY.—The Department of Commerce has ready for distribution its booklet on "Electrical Machinery, Apparatus and Supplies." The material has been prepared under the supervision of M. W. Steuart, chief statistician for manufacturers.

CONDUIT FITTINGS. — The Killark Electric Manufacturing Company of St. Louis has prepared three sheets for its general catalog descriptive of its electrolet conduit fittings. This company has also prepared a sheet descriptive of its Killark bell-ringing transformer.

STOKERS. — The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared leaflet No. 3987, descriptive of its underfeed stoker. This company has also prepared leaflet No. 1700, superseding leaflet No. 3790, descriptive of its full magnetic elevator control, type C.

NEW WAR LAWS.—The war tax law and the "trading with the enemy" act, passed at the recent session of Congress, have been carefully annotated, epitomized and indexed, and the unabridged text of each statute is published in book form by the Guaranty Trust Company, 140 Broadway, New York. Copies of these valuable compendiums may be had on application.

EXPORT TRADE.—"Utility Letters of Credit in the Export Trade—A Plea for Standard Forms" is the title of a new pamphlet issued by the American Steel Export Company of New York. In this article the author, J. P. Beal, who is secretary and assistant treasurer of this company, makes recommendations that should be heeded by the American banker and exporter. He has indicated a point of weakness which to him seems worthy of immediate attention, to the betterment of our entire overseas financial facilities.

MANAGEMENT.—An eighty-page book explaining the successful methods which John F. Sherman employs in eliminating discord and promoting harmony between employer and employee has been prepared. It contains many features valuable to executives at this time. The main offices of the "Sherman Service" at 20 Broad Street, New York City; 208 South La Salle Street, Chicago; 10 State Street, Boston, and 42 Church Street, New Haven, Conn., are sending out this book to executives only who request it on their corporation's letterhead.

FOREIGN TRADE OPPORTUNITIES. —In the "Commerce Reports" of Oct. 22, published by the Bureau of Foreign and Domestic Commerce, several inquiries from European buyers appear for electric toys, appliances, machinery and supplies, pumps and motors. The bulletin also has a complete conservation list and one of articles requiring export license. A subsequent number furnishes "don'ts" to be carefully noted in connection with "introductory methods" followed in the Chinese trade, where the demand is growing rapidly for electric goods of various kinds.

New Incorporations

THE ELECTRIC SUPPLY COMPANY of Clearfield, Pa., has been incorporated with a capital stock of $5,000 by W. W. Wrigley and others.

THE ELECTRIC UTILITIES COMPANY of Detroit, Mich., has been incorporated with a capital stock of $20,000 by D. C. Seymour, L. R. Wilbur and F. A. Tilton.

THE ELECTRICAL CONSTRUCTION COMPANY of Racine, Wis., has been incorporated with a capital stock of $18,000 by Charles F. Breitzke and William B. Pierce.

THE AUTOMATIC ELECTRIC DEVICES COMPANY of Cincinnati, Ohio, has been incorporated by Clarence E. Ogden, W. N. Simlick and others. The company is capitalized at $10,000.

THE NATIONAL ARMATURE & ELECTRIC WORKS of Bluefield, W. Va., has been incorporated with a capital stock of $25,000 to carry on a general electrical repair business in Bluefield.

THE NEW JERSEY GAS & ELECTRIC COMPANY of Morristown, N. J., has been incorporated to construct and operate an electric and gas plant. Edwin Hawley, Van Wyck, is interested in the company.

THE NORTHWESTERN LIGHT & POWER COMPANY of Mount Prospect, Ill., has been incorporated by William Busse, Edward Busse, Henry J. Ehard, Ralph L. Peck and Henry Beigel. The company is capitalized at $5,000.

THE PUBLIC SERVICE POWER COMPANY of New York, N. Y., has been chartered with a capital stock of $250,000 to develop hydroelectric projects. The incorporators are: Charles H. Stanton, J. F. Hory and William M. Card.

THE NEWARK MACHINE & ENGINEERING COMPANY of Newark, N. J., has been incorporated by Emanual P. Scheck, Lewis Fisher and E. I. Quinn. The company is capitalized at $100,000 and proposes to deal in machinery.

THE EMPIRE ELECTRIC STEEL CORPORATION of New York, N. Y., has been incorporated with a capital stock of $500,000 to do a general contracting business. The incorporators are: George R. Hamilton, Eric Pusinell and E. H. Rapp.

THE CUMBERLAND POWER COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000. The incorporators are: F. D. Buck, K. E. Longfield and M. L. Horty of Wilmington, Del.

THE DEAN & STEWART ELECTRICAL COMPANY of Dunkirk, N. Y., has been chartered with a capital stock of $2,5000 to manufacture lamps and electrical fixtures. The directors are: John Dean, Edward G. Dean and Ernest H. Stewart all of Dunkirk.

THE HOOSIER GAS & POWER COMPANY of Indianapolis, Ind., has been chartered with a capital stock of $100,000 to operate an electric generating plant. The incorporators are: Francis J. Catternin, Wilkins W. Wiswell and Justice D. Detwiler.

THE H. B. SHONTS COMPANY of New York, N. Y., has been incorporated by J. A. Smith, H. B. Shonts and P. J. Durham, 244 West Forty-ninth Street. The company is capitalized at $50,000 and proposes to manufacture motors, engines and electric batteries.

THE CRANK SHAFT COMPANY of Wilmington, Del., has been incorporated by C. L. Rimlinger, M. M. Clancy and Clement M. Egner. The company is capitalized at $60,000 and proposes to do a general electrical and mechanical engineering business.

THE MARTIN-McHOLLAN COMPANY of New York, N. Y., has been incorporated by G. W. Martin of Ridgewood, N. J.; J. Q. McHolland of Sparkill, and F. E. Anderson, 9 West Ninety-first Street, New York, N. Y. The company is capitalized at $50,000 and proposes to do a general electrical, mechanical, civil, water supply and mining engineering business.

THE SMYRNA MILLS ELECTRIC LIGHT & POWER COMPANY of Houlton, Me., has been chartered with a capital stock of $10,000 to generate and distribute electricity in the towns of Smyrna, Oakfield, Merrill and Dyer Brook. The officers are: Peter J. Garcelon of Houlton, president; Arthur A. Garcelon of Merrill, treasurer, and Walter E. Matthews of Oakfield, clerk.

New England States

BOSTON, MASS.—Work has begun on the construction of an electric street car line to the new South Boston Fish Pier. The line will connect with the Boston Elevated Railway at the junction of Summer Street extension. The cost of the road is estimated at $30,000.

BOSTON, MASS.—Bids will be received by the purchasing committee of the Commonwealth of Massachusetts, Room 38, State House, Boston, until Nov. 27, for furnishing approximately 50,000 incandescent lamps for certain institutions, boards and commissions of the Commonwealth of Massachusetts. For details see Searchlight Section.

BOSTON, MASS.—The Aberthaw Construction Company of Boston, Mass., has awarded a contract to the Baldwin-Stewart Electrical Company, 214 Pearl Street, Hartford, Conn., to wire and install all electrical apparatus in the United States government factory which is being erected by the former in Squantum, a suburb of Boston.

FALL RIVER, MASS.—The Fall River Electric Light Company has been granted a permit for the erection of a one-story substation on Hathaway Street, to cost about $19,000. Beattie & Cornell are contractors.

SPRINGFIELD, MASS. — Work has begun on the erection of a three-story addition to the plant of the Standard Electric Time Company, Logan Street, to cost about $25,000.

PROVIDENCE, R. I.—Work has begun by the Bethlehem Shipbuilding Corporation, Fore River Works, for the erection of a one-story boiler plant, 140 ft. by 550 ft., with two ells, at Fields Point, Providence.

EAST HAMPTON, CONN.—The Public Utilities Commission has approved the petitions of the Central Connecticut Power & Light Company of East Hampton for the erection of an electric transmission line in the town of Lyme between the Hadlyme post office and the Hadlyme dock; also for the proposed extension of a 2200-volt lighting circuit upon an existing line of poles in South Glastonbury.

GROTON, CONN.—The question of enlarging the municipal electric-light plant is under consideration by the Borough Council.

NEW HAVEN, CONN.—The Public Utilities Commission has given its approval of the erection of an electric transmission line from Station A of the Connecticut Company in New Haven to Middletown Avenue along the private right-of-way and across highways in the town of North Haven.

STAMFORD, CONN.—The plant of the John Davenport Company has been taken over by Morris C. Rosenbaum and others. The Bridgeport and Newark companies will be consolidated with the new organization in the manufacture of gasoline engine and electric truck equipment. Several additions, it is understood, are contemplated.

Middle Atlantic States

ROCHESTER, N. Y.—Plans have been filed by the Bridgeford Machine & Tool Corporation for the construction of a new power house on North Third Street, Rochester. Contract has been awarded to Fred Belt, 42 Copeland Street, Rochester.

BRONXVILLE, N. Y.—The Public Service Commission has refused to grant the petition of the Lawrence Park Heat, Light & Power Company of Bronxville to supply electricity in the business section to compete with the Westchester Light & Power Company. Originally the Lawrence Park company was intended only to light buildings owned by the members of a family that owned the company.

BROOKLYN, N. Y.—The National Aniline & Chemical Company is planning to build an extension to power house, 36 ft. by 87 ft., to cost about $30,000, at the corner of Ditmas Avenue and Eighty-third Street.

BROOKLYN, N. Y.—Plans are being prepared for the erection of a new one- and two-story, 100-ft. by 200-ft. ice-manufacturing plant for Rubel Brothers, Inc., Glenmore Avenue, Brooklyn. The proposed plant will be erected at Blake Avenue, and will cost about $75,000.

BUFFALO, N. Y.—Plans have been filed by the New York Central Railroad Company for the construction of a new signal tower, two stories, 20 ft. by 55 ft., at its local works, on Curtis Street, to cost about $5,000. Contract has been awarded to the Eastern Concrete Steel Company, Morgan Building, Buffalo.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

BUFFALO, N. Y.—Extensive additions are being made to the generating equipment in the power plant of the International Railway Company. Substations are being erected at North Division and Oak Streets and in Military Road near the Hertel Avenue carhouse. The new 10,000-kw. generating unit at the old Niagara Street power house will soon be ready to put in operation.

BUFFALO, N. Y.—The Buffalo, Rochester & Pittsburgh Railway Company is making improvements to its shops and yards at East Salamanca, N. Y., including the construction of a new machine shop and plant to be used for heavy locomotive repair work. The capacity of the roundhouse will be increased and the power house remodeled and enlarged. The company is also making extensions at Punxsutawney, Pa., including the erection of a new engine terminal, 16-stall roundhouse and other buildings.

CENTRAL ISLIP, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Nov. 14, for power house for heating and lighting plant, construction, heating and sanitary work at the Central Islip (N. Y.) State Hospital. Drawings and specifications may be consulted at the Central Islip State Hospital and at the New York office of the Department of Architecture, 1224 Woolworth Building, New York City. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher, Capitol, Albany, is state architect.

FLUSHING, N. Y.—Work has begun on the construction of the new substation for the New York & Queens Electric Light & Power Company on Lawrence Street, north of Broadway. The station will provide electricity for the residents and factories of the Third Ward in Queens Borough.

NEW YORK, N. Y.—The American Ice Company has decided to purchase energy from the New York Edison Company owing to the shortage and uncertainties of the fuel supplies. The ice company has 15 ice plants in the Metropolitan district.

NEW YORK, N. Y.—A new fire alarm system is being installed, which, when completed, will give the borough of Manhattan 1651 fire alarm boxes where there are but 861 at present. The new fire alarm headquarters on the Seventy-ninth Street Transverse Road in Central Park will be opened as soon as the installation of the boxes is completed.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 19 for provision and installation of an extension to and the rearrangement of the pneumatic-tube transmission system in the navy yard, New York. Drawings and specifications (No. 2658) may be obtained at the above bureau or at the navy yard named.

SCHUYLERVILLE, N. Y.—Work has begun on the construction of a new power plant for Saratoga Victory Manufacturing Company at Schuylerville. The Kingsbury Construction Company has the contract.

DOVER, N. J.—Plans are being prepared for the construction of a new assembling plant and igniter building at the Picatinny Arsenal of the United States government, for which $40,000 has been appropriated.

NEWARK, N. J.—Plans have been filed by the Miner Edgar Company for the erection of a new four-story addition 70 ft. by 165 ft. to its power plant on Blanchard Street. Contract has been awarded to Frederick Ilgus, Inc., 13 South Sixth Street, Newark.

NEWARK, N. J.—Plans have been prepared for the installation of a large condenser at the Essex power station of the Public Service Electric Company. The condenser will have a condensing capacity of 420,000 pounds of steam per hour, and will be equipped with two auxiliaries for the circulation of the water.

NEWTON, N. J.—Preparations are being made by the Newton Electric & Gas Company for the installation of new lamps in the Stewart Street section, work on which has already begun. The company is also making extensive improvements in its system.

NEW BRUNSWICK, N. J.—Bids will be received by the Board of Chosen Freeholders of the county of Middlesex, County Building, New Brunswick, until Nov. 12, for furnishing 20 or more 40-cp. incandescent electric lamps or two or more 80-cp. incandescent electric lamps, and also three single-mantle Welsbach incandescent lamps for a period of three years.

WRIGHTSTOWN, N. J.—Contract has been awarded by Mastbaum Brothers & Fleicher, 1424 South Penn Square, Philadelphia, Pa., for a new electric lighting and heating plant at its local works.

ASHLEY, PA.—Plans have been filed by the Central Railroad of New Jersey, 143 Liberty Street, New York City, for the erection of an addition to power house, 40 ft. by 70 ft., at its local works, to cost about $10,000. Contract has been awarded to John W. Ferguson of Paterson, N. J.

BOYERTOWN, PA.—The Boyertown & Pottstown Railway Company has submitted a proposal to the Town Council to connect its system with the Oley Valley Electric Railway to Reading. It is proposed to do this by means of a loop on several streets, and thus complete the last electric railway link between Reading and Philadelphia.

DOVER, PA.—The Dover-Rossville Transit Company, which proposes to operate a trackless trolley railway between Dover and Rossville, has applied for a franchise to erect poles and power lines on the State highways in York County.

PHILADELPHIA, PA.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of new mechanical equipment at the government marine works, Philadelphia, to cost about $99,000.

PITTSBURGH, PA.—Plans are being prepared by Ballinger & Perrot of Philadelphia for heating, electrical and elevator equipment for the seven-story addition to the factory of the Pennsylvania Chocolate Company to be erected at Pittsburgh.

ROSEDALE, PA.—The board of school directors has authorized the installation of electric lamps in the Rosedale school house.

WILLIAMSPORT, PA.—Preparations are being made by the United States Rubber Company of Williamsport for the erection of a five-story addition to its plant. The construction of a new power plant is included in the plans.

WILMINGTON, DEL. — The Illinois Leather Company, South Market, Wilmington, is building power plant addition, 19 ft. by 40 ft., at its works.

BALTIMORE, MD.—Plans are being prepared for a new electric distributing station for the Consolidated Gas, Electric Light & Power Company to be erected on Custom House Avenue. Contract, it is understood, will be awarded in the spring.

CHARLESTON, W. VA.—The power plant of the West Virginia Water & Electric Company was badly damaged by fire recently.

GLENVILLE, W. VA.—Bids will be received by the County Court of Gilmer County, Glenville, until Dec. 1, for the construction of a court house, jail and jailer's residence, including electric and gas lighting, steam heating, etc. The cost is estimated at about $55,000. Plans and specifications may be obtained at the office of A. F. Wysong, architect, Princeton, W. Va.

RICHMOND, VA.—The contractors have been directed by the Administrative Board to proceed with the completion of the annex to the municipal electric-light plant. A concrete base is to be installed for the new turbo-generator. The generator ordered having been seized by the United States government, the city will have to wait until the General Electric Company can build another and ship it to Richmond.

WASHINGTON, D. C.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 19 for fitting out cranes and other work at the Brooklyn Navy Yard, to cost about $850,000. Plans are also under way for the construction of a new 50-ton crane, to cost about $150,000.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 3 for supplying to various public buildings under the control of the Treasury Department hand, electric, portable vacuum cleaners during the fiscal year ending June 30, 1918. For details see Searchlight Section.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 26 for the construction of two 200-ft. steel towers at the naval radio station at St. Thomas, Virgin Isles, West Indies. Drawings and specifications (No. 2568) may be obtained upon application to the above bureau.

North Central States

ALMA, MICH.—The new power plant of the Central Michigan Light & Power Company in Alma, it is expected, will be completed about the middle of November. Arrangements will then be made by the company to furnish heat to the Republic Truck plant when it is completed.

DETROIT, MICH.—Plans prepared by Malcomson & Higginbotham for the erection of a new annex to the Cass Technical School have been approved by the Board of Education. The first unit of the building will be a two-story structure of reinforced concrete, 193 ft. on Second Avenue, 60 ft. on High Street and it will be 166 ft. deep. The cost is estimated at $250,000. The plans provide for enlarging the building to seven stories and connecting it with the present Cass Technical School by tunnel and viaduct.

GRAND RAPIDS, MICH.—Plans have been prepared by John C. Parker, head of the Department of Electrical Engineering at the University of Michigan, for improvements to municipal electric lighting system, which if adopted will save the city many thousands of dollars in upkeep and fuel bills and greatly improve the street-lighting system. The City Commission recently included $30,000 in the budget for a new turbo-generator. This will not be necessary under the plans recommended by Mr. Parker, which include the use of the nitrogen-filled incandescent lamp, using 600, 400-cp. and 250-cp. units. The cost of these changes is estimated at $35,000. The installation of a new turbo-generator would take 18 months. The new system proposed by Mr. Parker can be put in operation in about eight months. Suggested refinements in the power plant should save at least $18,000 in coal.

KALAMAZOO, MICH. — The Michigan State Telephone Company is contemplating the erection of two additional copper wire circuits between Kalamazoo and Grand Rapids. A. W. Robb, 318 South Burdick Street, is manager.

TRAVERSE CITY, MICH.—The power plant of the Boardman River Electric Light & Power Company, recently destroyed by fire, causing a loss of about $50,000, will be rebuilt at once.

CANTON, OHIO.—Plans have been completed by the Canton & Ohio River Railways Company for the construction of its proposed electric railway, which will extend from Canton, Ohio, to Kingwood, W. Va., a distance of about 180 miles. The proposed road will cover a trackage of about 400 miles. Power plants for the Kingwood division will probably be located at Cameron and Morgantown, although definite plans have not yet been made. On the Ohio side the substations will probably be located at Minerva, Carrollton, Toronto and Martins Ferry. The cost of the road complete is estimated at $6,000,000. James D. White of Pittsburgh, Pa., is secretary and treasurer.

CHILLICOTHE, OHIO.—The United States government, it is reported, will build a double-track extension of the Chillicothe Electric Railroad, Light & Power Company to Camp Sherman.

CINCINNATI, OHIO.—Steps have been taken to secure the consent of the property owners on Elberon Avenue between Eighth and Warsaw Streets for the extension of the car tracks to establish the Warsaw-Elberon line.

COLUMBUS, OHIO.—Bids will be opened on Dec. 3 by the Ohio State University, Columbus, for power plant equipment, including stoker for a 600-hp. boiler. Specifications may be obtained from Carl E. Steeb, secretary.

COLUMBUS, OHIO.—The plant formerly operated by J. B. Hoover at 619 North Fourth Street has been taken over by the Capital Die, Tool & Machine Company of Columbus, recently incorporated, which will continue to manufacture dies, jigs and other small tools. The company also manufactures metal heat-treating furnaces.

TOLEDO, OHIO.—The Lewis Electric Welding & Manufacturing Company of Toledo, recently incorporated with a capital stock of $100,000, has taken over the business of the Lewis Foundry Company. Some extensions, it is understood, will be made to the plant. The company will specialize on semi-cast head valves for gas, gasoline and oil engines.

COVINGTON, KY.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 4 for remodeling an electric passenger elevator in the United States court house and post office at Covington. For details see Searchlight Section.

LOUISVILLE, KY.—The Roy C. Whayne Supply Company of Louisville contemplates the purchase of a 7½-hp. or 10-hp., 25-cycle, direct-current motor, 220 or 440 volts; also a 4-ton electric locomotive, 250 volts, direct-current, 40-in. gage.

LOUISVILLE, KY.—The Louisville Gas & Electric Company is planning to install new generating machinery and auxiliary equipment at its electric power plant. H. M. Byllesby & Company, 208 South La Salle Street, Chicago, Ill., are engineers.

ELWOOD, IND. — The Indiana General Service Company of Elwood has petitioned the Public Service Commission for permission to purchase and absorb the Marion (Ind.) Light & Heat Company and the Muncie (Ind.) Electric Light Company.

BYRON, ILL.—The plant and holdings of the Byron Electric Light & Power Company have been purchased by the Illinois Northern Utilities Company of Dixon.

PEKIN, ILL.—The City Commissioners are considering a proposal submitted by the Central Illinois Light Company for the installation of an ornamental lighting system in Pekin.

MILWAUKEE, WIS.—Van Ryn & DeGelleke, architects, Caswell Block, Milwaukee, have been engaged by the board of school directors of Milwaukee to prepare plans for a new high school, with manual training department, to be erected at Lenox and Montana Streets, Bay View, to cost about $600,000. Bids, it is understood, will be asked for early in December. Frank M. Harbach is secretary and business manager.

MILWAUKEE, WIS.—Work has started on the installation of three units of the new lighting system. The first unit takes in the Auditorium district, extending from the Auditorium proper and Fifth Street, from Auditorium to Grand Avenue; the second is on Grand Avenue from the bridge to Seventh Street, and the third on Wisconsin Street, from the bridge to the lake. The management of the Auditorium Building will erect four double-bracket posts on Cedar Street, four on Fifth Street, four on Sixth Street and three on State Street. Each post will be mounted with two lamps of 1000 cp. each. The Illumination Bureau has completed the installation of concrete posts on Grand Avenue from Sixteenth Street to the western limits. Each post will carry an individual harp-style lamp. It is expected to have the new lamps ready to put in operation before Christmas.

ST. PAUL, MINN.—The St. Paul Real Estate Board has indorsed the campaign to establish a municipal electric-light and power plant. A committee will be appointed to co-operate with the city officials in their efforts to promote the project.

CEDAR RAPIDS, IOWA.—The contract for electrical work on the new Young Men's Christian Association Building has been awarded to the W. L. Fowler Electric Company of Cedar Rapids. The cost of the building is estimated at $160,000.

CLINTON, IOWA.—The contract for the erection of an electric transmission line from Charlotte to the County Poor Farm has been awarded to J. J. Maher.

COUNCIL BLUFFS, IOWA.—Extensive improvements are contemplated by the Union Pacific Company to its local works involving an expenditure of about $2,000,000, and will include a new 40-stall roundhouse, machine shops, power plant and coaling station, freight trackage, etc.

SPIRIT LAKE, IOWA.—Contract has been awarded by the Knights Templar of Iowa for the construction of a hotel and administration building, including electric wiring and plumbing, to the Guarantee Construction Company of Cedar Rapids, at $93,960.

VAIL, IOWA.—A petition is being circulated asking that an election be held to vote on the proposal to issue bonds for the erection of an electric transmission line from Bennison to Vail.

JOPLIN, MO. — The Empire Electric Supply Company has petitioned the Public Service Commission for authority to sell all its holdings to the Empire District Electric Company of Joplin.

ST. JOSEPH, MO.—Extensive improvements are contemplated by the Western Union Telegraph Company to its local system, including the installation of underground conduits, cables and new apparatus at its office, to cost about $100,000.

SPRINGFIELD, MO.—Negotiations have been closed between the Springfield Gas & Electric Company and the management of the Frisco Lines, whereby the power plant of the latter, located just west of the Frisco general office building, will be taken over by the Springfield company. The plant will be used as an auxiliary and will furnish heat to downtown business buildings.

CLAY CENTER, NEB.—The contract for electric wiring in the new court house at Clay Center has been awarded to the Standard Electric Company of St. Joseph, Mo., at $1,390. W. F. Gernandt, Keeline Building, Omaha, is architect.

JOHNSTOWN, NEB.—Preparations are being made for the installation of a municipal electric-lighting plant in Johnstown, for which bids have been received. The cost is estimated at $4,700. Bruce & Standevan, Bee Building, Omaha, are engineers.

OMAHA, NEB. — Plans are being prepared by James T. Allen, architect, Brandeis Theater Building, Omaha, for the erection of a garage at Eighteenth and Davenport Streets, at a cost of $20,000. Bids are being asked by the architect on electric wiring, heating and plumbing for the building.

ORD, NEB.—At an election held recently the proposal to issue $30,000 in bonds for the installation of an electric-lighting system was carried.

PENDER, NEB.—All bids submitted for improvements to the municipal electric-lighting system were rejected. Bonds to the amount of $16,000 were recently voted for the work. The Henningson Engineering Company of Omaha has charge of the engineering work.

SALINA, KAN.—Alterations are being made in the boiler room of the Salina Light, Power & Gas Company, which will provide for the burning of coal under the boilers. In the past oil burners have been used exclusively. The change is being made to meet the possible shortage of oil.

SMITH CENTER, KAN.—The contract for electric wiring for the new court house at Smith Center has been awarded to the Hubbard Electric Company of Beloit, at $1,273.

WINFIELD, KAN.—Contracts have been awarded by the city of Winfield for equipment for water-works system as follows: To the American Cast Iron Pipe Company for cast-iron pipe, at $59,856; American Well Works Company for eight pumps, $5,850; Charles A. Millbank Company of Kansas City, Mo., for eight motors, $3,526, and 15 transformers, $3,365; the B-R Electric Company of Kansas City, Mo., for telephones and switchboard equipment.

Southern States

BADIN, N. C.—All contracts for the construction and equipping the second Yadkin River dam at Yadkin Falls site 2 miles below the Narrows dam have been awarded by the Tallassee Power Company, a subsidiary of the Aluminum Company of America of Pittsburgh, Pa., as follows: For construction of dam and power house at dam site near Badin to the Hardaway Contracting Company of Columbus, Ga.; three vertical turbines, capable of developing 10,000 hp. each under a 50-ft. head, to the S. Morgan Smith Company of York, Pa.; generators to the Central Electric Company of Schenectady, N. Y.; governors to the Allis-Chalmers Company of Milwaukee, Wis., structural steel in floodgate and power house to the McClintic Marshall Construction Company of Pittsburgh, Pa. Other contracts covering miscellaneous equipment have been let. James W. Rickey is chief hydraulic engineer of the Aluminum Company of America.

FREMONT, N. C.—The Town Commissioners are considering issuing $20,000 in bonds, the proceeds to be used for improvements to the municipal electric-light plant, streets and sidewalks.

PIKESVILLE, N. C.—The proposal to issue bonds for the installation of a municipal electric-light plant is under consideration by the Town Commissioners.

REIDSVILLE, N. C.—At an election held recently the voters ratified the sale of the municipal electric-light plant to the Southern Public Utilities Company of Charlotte. The company was also granted a 30-year franchise.

ATLANTA, GA.—The American Machine & Manufacturing Company is adding an ammunition department to its present plant and has made arrangements with the Georgia Railway & Power Company for energy calling for approximately 500 hp. additional service, 220 volts, three-phase, 60 cycles.

ATLANTA, GA.—The Armour Fertilizer Works have closed a contract with the Georgia Railway & Power Company for approximately 800 hp. This service will displace the present 220-volt direct-current isolated plant. The new equipment will operate at 550 volts, three-phase, 60 cycles, and will include fire and service pumps and air compressors.

DECATUR, GA.—The City Council is considering entering into a contract with the Georgia Railway & Power Company of Atlanta for the construction of an electrically operated pumping station for water-works system.

SOPERTON, GA.—At an election held recently the proposal to issue $10,000 in bonds to establish a municipal electric-light plant was defeated.

JACKSONVILLE, FLA. — The Jacksonville, Miami & Tampa Interurban Railway Company is contemplating the construction of an electric railway from Jacksonville to Miami, with a cross line from Melbourne to Haines City, and thence to Tampa, Fla., a total distance of about 500 miles. Surveys will soon be made and work, it is understood, will begin this winter. True Davis of St. Joseph, Mo., is president.

CHARLESTON, MISS.—Bids will be received by the Mayor and Board of Commissioners of Charleston, Miss., until Nov. 20 for improvements to the municipal electric-light plant and water-works system, including alternators and miscellaneous for the electric plant, and oil engines, pumps, deep well, reservoir, elevated tank and oil-storage facilities for water-works system. Plans and specifications may be obtained on application to Xavier A. Kramer, consulting engineer, Magnolia, Miss.

EARLE, ARK.—The capital stock of the Earle Light, Water & Ice Company has been increased from $15,000 to $60,000.

FORDYCE, ARK.—The Ashcroft-Hampton Manufacturing Company, recently incorporated with a capital stock of $40,000, is planning to install an ice manufacturing and cold storage plant. Joseph Ashcroft, G. M. Hampton and others are interested in the project.

NEW ORLEANS, LA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 26 for the construction of radio buildings, including a one-story wood-frame dormitory, an outhouse and a brick receiving building, including electrical work, plumbing, etc., at the naval station at New Orleans. Drawings and specifications (No. 2649) may be obtained on application to the above bureau or the commandant of the naval station named.

FORT TOWSON, OKLA.—The installation of an electric-light plant is under consideration. W. S. McKinney is reported interested in the project.

BREMOND, TEX.—The electric plant of the Bremond Electric Light Company was recently destroyed by fire.

DECATUR, TEX.—Improvements are contemplated at the municipal electric-light plant, including the installation of a new engine and other machinery.

DILLEY, TEX.—J. D. Seamonds of Dilley is contemplating the installation of an irrigation pumping station on the Leona River near Dilley.

NAVASOTA, TEX.—The Intermountain Light & Power Company, it is reported, will rebuild its local distributing system.

QUANNAH, TEX.—Plans are being considered by Charles Sumner and associates for the construction of a water-works system, including a pumping station, to cost about $150,000.

STAMFORD, TEX.—The Stamford Gas & Electric Company, which recently completed the erection of an electric transmission line to Hamlin, is planning to extend the line to Anson. Three new substations will be built.

WOLFE CITY, TEX.—The City Council is considering increasing the municipal water supply and may install a new pumping plant.

Pacific and Mountain States

EVERETT, WASH.—The City Council has engaged Burns & McDonnell, consulting engineers, Interstate Building, Kansas City, Mo., to complete preparations of plans in connection with the proposed site on the Sultan River for a municipal electric-light plant. The Commissioners are contemplating calling a special election to submit the question of issuing bonds for the project to the voters.

LA CONNER, WASH.—The sum of $21,000 has been raised by the residents of La Conner for the erection of an electric transmission line from Mount Vernon to La Conner. The line will be built by the Puget Sound Traction, Light & Power Company under an agreement made between the company and the citizens of La Conner. The proposed line will be 21 miles long and will transmit 6600 volts, furnishing a 24-hour service. Owing to financial difficulties the local plant has closed down.

OLYMPIA, WASH.—The transmission lines of the Stone & Webster Corporation, which will transmit energy from the Fernhill power plant to Olympia, will soon be completed. The Fernhill station is located about 40 miles from Olympia. A pole transmission line has been built from Fernhill to Tumwater, where a transformer station has been erected to receive the power. The station is equipped with three 500-kva. transformers. The cost of the entire work is estimated at about $75,000.

PORT ANGELES, WASH.—The municipal electric-lighting system was badly damaged recently. The large transformer was put out of commission and the switchboard and its instruments badly damaged. The system has been temporarily repaired, but is in a precarious condition.

PORT WASHINGTON, WASH.—Extensive improvements are needed at the municipal electric-light plant to enable it to meet the demands for electrical service.

COQUILLE, ORE.—The Sitka Spruce Company of Coquille has secured an additional water power and will install electric generating machinery and electric-lighting equipment, preparatory to doubling the output of its plant.

DALLAS, ORE. — Extensive improvements are being made to the local power plant of the Oregon Power Company, including the installation of a 750-hp. tandem compound engine, to replace a 150-hp. engine. A 450-kw. generator is also being installed. The output of the plant will be increased from 770 hp. to 1700 hp.

ECHO, ORE.—The Council and Echo Commercial Club are considering the installation of cluster lamps on the streets this winter.

MEDFORD, ORE.—The Copco (Cal.) plant of the California-Oregon Power Company will be put in operation about Dec. 1. The plant represents an expenditure of about $2,000,000, and will have a generating capacity of 25 000 hp., which will be increased to 50,000 hp. by a subsidiary station a quarter of a mile down the river.

PORTLAND, ORE.—The Pacific Power & Light Company, operating in Oregon and Washington, has recently sold an issue of $750,000 in bonds, the proceeds to be used to pay for extensions and improvements made this season and others under consideration to provide for the increasing demand for electrical service in the Columbia River basin towns.

AUBURN, CAL.—Arrangements, it is reported, are being made by the Pacific Gas & Electric Company to discontinue the use of the old Newcastle electric power plant. Transformers are being installed at the Wise power plant in Auburn ravine below Auburn to take on the Auburn-Newcastle load.

CALEXICO, CAL.—The State Railroad Commission has authorized the Southern Sierras Power Company to install a new electric auxiliary plant at Calexico. The Holton Light & Power Company must cooperate with the Sierras company in this undertaking.

FRESNO, CAL.—The Pacific Gas & Electric Company of San Francisco is erecting a machine shop in connection with its new generating plant near the West Side Branch of the Southern Pacific Railroad, near Fresno.

FRESNO, CAL.—The San Joaquin Light & Power Company of Fresno has purchased the plant and power lines of the Merced Stone Company at Kittridge, Mariposa County, and will extend the transmission lines to several mining claims as well as Coulterville.

FRESNO, CAL.—The State Railroad Commission has authorized the San Joaquin Light & Power Corporation to operate under a franchise granted the company by Mariposa County in July in that portion of the county not now served by any other utility company.

HOLTVILLE, CAL.—Preparations are being made to put the local plant of the Holton Power Company in operation to be used as an auxiliary for the power service furnished by the Southern Sierras Company of Riverside. W. H. Brown of El Centro is superintendent of the electrical department.

LOS ANGELES, CAL.—The Southern California Edison Company of Los Angeles has filed an application with the United States district engineer for permission to erect a high-tension transmission line across Newport Bay.

LOS ANGELES, CAL.—Application has been made to the State Water Commission by the United Light & Power Company, represented by F. C. Riley and G. W. Gilbreth of Los Angeles, for permission to appropriate 15 cu. ft. per second of water from the San Gabriel River in Los Angeles County to be used for generating electricity for commercial purposes. Impulse wheels directly connected to generators will be used. A total fall of 1280 ft. will be secured and 10,000 hp. will be generated. The proposed work includes the driving of a tunnel and pipe line 2½ miles long and the construction of a dam 200 ft. high and 500 ft. long.

MERCED, CAL.—The installation of a municipal electric-light plant in Merced is under consideration.

NORTH BEND, CAL.—The North Bend Mill & Lumber Company has purchased the property adjoining the North Bend Iron Works and is installing an electrically driven planing mill and lumber finishing plant, 140 ft. by 160 ft., at a cost of $100,000.

SAN JOSE, CAL.—All distribution and power lines of the San Jose Railroads and the Peninsular Railway Company have been taken over by the Pacific Gas & Electric Company. Up to the present time the railways have furnished electrical service in San Jose and on the outskirts of the city and to residents along the car lines.

SONOMA, CAL.—San Francisco capitalists have purchased the property of the Sonoma Water, Light & Power Company at El Verano, which has been furnishing a large portion of the Sonoma Valley and the town of Sonoma with water. The new owners, it is understood, will acquire further water rights and make additional extensions to the service.

TAHOE CITY, CAL. — Application has been made to the State Water Commission by Lora J. Moore of Tahoe City for a half second-foot of waters of Slim Jim Creek, a tributary of Lake Tahoe, in Placer County, for the purpose of developing electric power. The plans call for the construction of a rubble dam 12½ ft. high and 200 ft. long, and a fall of 309 ft. It is proposed to develop 17½ hp. at a cost of about $10,000.

WILLOWS, CAL.—Application has been made to the State Water Commission by W. F. Fowler of Willows for 250 cu. ft. per second of water of the Sacramento River for rice culture on 14,000 acres. The water will be raised by electrically driven pumps to the main canal which is given as 10 miles in length. The cost of the proposed project is estimated at $180,000.

GRANGEVILLE, IDAHO—The Grangeville Light & Power Company is building a dam across the South Fork of the Clearwater River, at a point between the present power house and the present dam. It is expected to have the concrete dam completed within six months.

BUTTE, MONT.—Preliminary work has been completed, including surveys, and plans prepared by the Montana Power Company for a large hydroelectric development at Kootenai Falls, at a cost of about $6,000,000. The proposed plant will have a head of 110 ft. and develop 68,000 hp.

GREAT FALLS, MONT.—The construction of a substation in the downtown section, to cost from $150,000 to $175,000, is under consideration by the Montana Power Company.

MOORE, MONT.—Preparations are being made by the Montana Power Company of Butte for a large hydroelectric power development at the foot of Mystic Falls, in Stillwater County.

PLEVNA, MONT.—The installation of an electric-light and power plant in Plevna is under consideration. Stater Brothers of Baker are interested in the project.

Canada

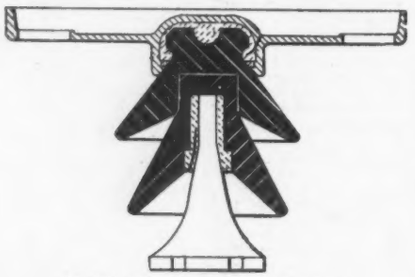
PENTICTON, B. C.—The Kettle Valley Railway Company, which owns and operates the section of the Coast-Kootenay railway between Midway and Hope, is planning to build a branch from Pendicton to Copper Mountain, a distance of 14 miles, at a cost of about $1,000,000.

TORONTO, ONT.—The Dominion Board of Railway Commissioners has authorized the Hydro-Electric Power Commission of Ontario to proceed with its agreements with the Niagara, St. Catharines & Toronto Railway, the Grand Trunk Railway and the Michigan Central Railway Companies for the construction of a power development canal and construction railway and for a temporary division of the tracks of the companies mentioned at Stamford Township, Ont.

Miscellaneous

GUANTANAMO, CUBA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington D. C., until Dec. 10 for fuel-oil fire protection, including the installation of pumps, motors, piping, distributing connections, etc., for a foam fire protection system for fuel-oil and gasoline tanks and reservoirs at the naval station, Guantanamo, Cuba. Drawings and specifications (No. 2636) may be obtained at the above bureau or from the commandant of the naval station named.

1,244,454. FAN-HANGER OUTLET; Frederick B. Adam, St. Louis, Mo. App. filed April 27, 1916. Provides a combined receptacle carrier and fan hanger that presents a neat and ornamental appearance at all times, thus overcoming the necessity of mounting a bracket, shelf, plate or other device on a wall, in addition to the receptacle carrier, for supporting a fan that is in use.



1,244,473—Insulating Support

1,244,473. INSULATING SUPPORT; Charles W. Covell, Wilkinsburg, Pa. App. filed Sept. 25, 1914. Has special reference to supports which may be utilized upon current-limiting reactance coils of various diameters.

1,244,476. CURRENT-COLLECTING DEVICE; John S. Dean, Wilkinsburg, Pa. App. filed July 3, 1914. Provides a relatively short and advantageously located conducting member or shunt for conducting current around the spiral spring which is customarily provided in many types of current-collecting devices.

1,244,478. CONTROLLER; Isidor Deutsch, Avalon, Pa. App. filed March 7, 1913. Drum type.

1,244,483. VAPOR RECTIFIER; Sidney W. Farnsworth, Pittsburgh, Pa. App. filed April 6, 1914. Applies more particularly to liquid electrodes therefor.

1,244,486. VACUUM-TYPE CONVERTER SYSTEM; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed Nov. 3, 1916. Improvement.

1,244,492. CONTROL SYSTEM; Arthur J. Hall, Wilkinsburg, Pa. App. filed Oct. 9, 1914. Means for preventing the making or breaking of control circuits having the full supply-circuit voltage impressed thereon, at more than one point in the system, throughout the operation thereof, thereby obtaining the well-known advantages of relatively low-voltage operation.

1,244,509. DYNAMO-ELECTRIC MACHINE; Benjamin G. Lamme, Pittsburgh, Pa. App. filed Aug. 22, 1913. Means for reducing the circulation of eddy currents in the laminations caused by fringing of the magnetic flux in the annular ventilating spaces.

1,244,511. UNIVERSAL MOTOR; Benjamin G. Lamme, Pittsburgh, Pa. App. filed Aug. 7, 1914. Provides simple and effective means for automatically adjusting the field strength of the motor in accordance with the character of the current supplied thereto.

1,244,518. METHOD OF AND APPARATUS FOR PRODUCING SPARKLESS COMMUTATION; John C. Lincoln, Cleveland, Ohio. App. filed May 5, 1913. Improvement.

1,244,528. VACUUM LIGHTNING ARRESTER; David T. May, New York, N. Y. App. filed Nov. 9, 1916. The present invention is characterized by the employment of deliquescent material which normally separates short-circuiting contact members that tend to engage one another. When the deliquescent material is softened by absorption of moisture carried into the evacuated container by the air when the vacuum fails, it permits the short-circuiting contact members to engage one another.

1,244,544. SELECTOR; Charles S. Rhoads, Jr., West Lafayette, Ind. App. filed Feb. 18, 1916. Is concerned more particularly with the production of a selecting device of use in systems of this or similar character.

1,244,545. SWITCHING DEVICE; Lynn G. Riley, Wilkinsburg, Pa. App. filed April 3, 1914. Particular reference to safety interlocking means that are adapted for use in controllers for automobiles and other vehicles of a similar nature.

1,244,555. SHIELDING SYSTEM FOR VAPOR CONVERTERS; Edmund F. Sipher, Wilkinsburg, Pa. App. filed Dec. 29, 1915. Improvement.

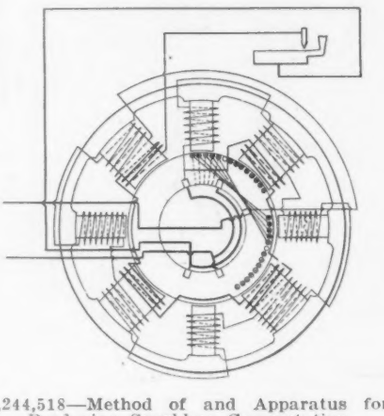
Record of Electrical Patents

Notes on United States Patents issued on October 30, 1917

1,244,569. MEANS FOR INTERCONVERTING ALTERNATING AND DIRECT CURRENTS; Joseph L. Woodbridge, Philadelphia, Pa. App. filed July 16, 1915. Applies especially to converting apparatus in which there is a magnetic structure, all parts of which are relatively fixed, upon which are wound suitable coils or windings connected to the alternating-current and direct-current circuits.

1,244,589. INCLOSED ELECTRIC FUSE; Robert C. Cole, Hartford, Conn. App. filed April 3, 1917. Renewable.

1,244,614. PROCESS OF AND APPARATUS FOR INTERCONVERTING AND ADJUSTING THE RELATIVE VOLTAGE OF HIGH-POTENTIAL ALTERNATING AND DIRECT ELECTRIC CURRENTS; Carl G. Koppitz, Youngstown, Ohio. App. filed Jan. 21, 1913. The present invention utilizes the broad principles set forth in said prior applications, but involves the provision of two pairs of brushes of opposite polarity which are



1,244,518—Method of and Apparatus for Producing Sparkless Commutation

rotated in unison but are relatively adjustable to vary the angular distance between the brushes of like polarity.

1,244,634. ELECTRICAL ATTACHMENT FOR READING METERS; Albert C. Neff, Urbana, Ohio, and Edwin H. Ford, Wabash, Ind. App. filed April 16, 1915. Particularly for those meters which are located at inconvenient points in residences or other buildings for registering gas, water and the like.

1,244,671. LOCK; Peder L. Wikheim, Everett, Wash. App. filed Sept. 11, 1916. Locks for ignition circuits and the like on automobiles.

1,244,705. METHOD OF ELECTRIC-ARC WELDING, HEATING AND METAL WORKING, AND APPARATUS THEREFOR; Charles L. Coffin, Parks, Ga. App. filed Feb. 7, 1917. Improvements.

1,244,709. WINDING FOR DYNAMO-ELECTRIC MACHINES; John C. Davenport, Norwood, Ohio. App. filed April 22, 1914. Improvement.

1,244,817. ELECTRIC HEATER FOR HOT-WATER TANKS; Russell A. Willson, Spokane, Wash. App. filed Feb. 15, 1917. Adapted for local application to a hot-water tank.

1,244,868. DYNAMO-ELECTRIC MACHINE; Gustaf M. Larsson, Newark, N. J. App. filed Dec. 12, 1913. Used for electric self-starters in automobiles.

1,244,873. SIGNALING APPARATUS; Fred W. Lohr, New York, N. Y. App. filed Jan. 11, 1915. For use on motor cars.

1,244,909. FILLING DEVICE FOR BATTERY CELLS; James M. Skinner, Philadelphia, Pa. App. filed Oct. 10, 1916. For use in supplying water or electrolyte to storage-battery cells.

1,244,926. ELECTRICAL DISTRIBUTER; Carl J. Wallace, Springfield, Ohio. App. filed July 31, 1915. Improvements.

1,244,927. DISTRIBUTER FOR AUTOMOBILE CIRCUITS; Carl J. Wallace, Springfield, Ohio. App. filed July 31, 1915. Improvements.

1,244,929. RHEOSTAT; Harry W. Ward, Detroit, Mich. App. filed March 6, 1917. Resistance to the current to be tested may be varied easily and with exact knowledge on the part of the operator as to the degree of change which his various adjustments of the parts is effecting.

1,244,945. STOKER-DRIVING ARM; John W. Bell, Covington, Ky. App. filed July 9, 1914. Improvements.

1,244,952. METHOD OF SEPARATING AND RECOVERING DOMESTIC REFUSE; Joseph W. Bryan, New York, N. Y. App. filed March 21, 1916. Improvements.

1,244,960. ELECTRIC DISTRIBUTION; John L. Creveling, New York, N. Y. App. filed Jan. 15, 1912. For cases where it is desired that a generator be automatically governed.

1,244,962. TELLTALE; John H. Derby, New York, N. Y. App. filed Dec. 7, 1915. Relates particularly to devices for indicating or controlling the height of a liquid in a reservoir, tank or other receptable or storage means.

1,244,983. ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINE; Louis J. Hunt, Sandycroft, Wales. App. filed Dec. 10, 1915. Improvements.

1,244,997. APPARATUS FOR SETTING BUNG BUSHINGS; Albert C. Ludlum, New York, N. Y., and Arthur Lowy, Newark, N. J. App. filed April 14, 1916. Provides a hand-operated device comprising a novel form of bushing setter with means for holding it in operative relation to the barrel and bushing.

1,245,036. PROTECTIVE CASING FOR ELECTRIC SERVICE CONNECTIONS AND METER DEVICES; Joseph Sachs, Hartford, Conn. App. filed Jan. 21, 1915. Improvements.

1,245,037. MULTIPLE-METER ADAPTER; Joseph Sachs, Hartford, Conn. App. filed July 26, 1916. Improvements.

1,245,038. METER-TESTING APPURTENANCE; Joseph Sachs, Hartford, Conn. App. filed Nov. 17, 1916. Improvements.

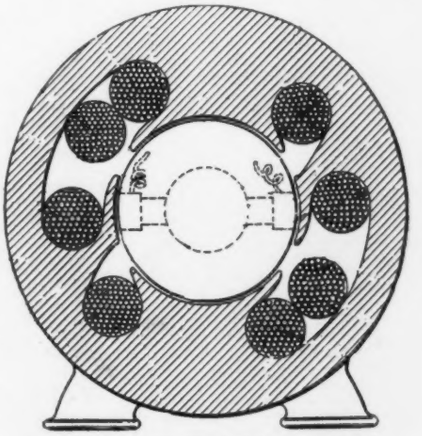
1,245,068. ATTACHMENT-PLUG FITTING; George B. Thomas, Bridgeport, Conn. App. filed April 10, 1916. Provides a receptacle with a signal device operated by the insertion of the plug.

1,245,077. JUNCTION-BOX COUPLING FOR ELECTRIC-WIRE CONDUITS; Lewis E. Webster, Wilkes-Barre, Pa. App. filed Oct. 14, 1915. Improvement.

1,245,080. BATTERY SEPARATOR; Frank E. Whitney, Philadelphia, Pa. App. filed Sept. 20, 1917. Provides a retaining plate which may also serve as a separator.

1,245,084. ELECTRIC HEATER; Edmund N. Brown, San Francisco, Cal. App. filed July 10, 1917. Heat waves are generated by a resistance coil or heating unit and are then reflected from a highly polished surface.

1,245,103. ELECTRIC SWITCH; John S. Hickman, Titusville, Fla. App. filed Dec. 29,



1,244,868—Dynamo Electric Machine

1916. Terminals are completely inclosed in sockets within slidable bars of insulation material.

1,245,105. FLASHER; Fred Hotchner, San Francisco, Cal. App. filed Feb. 23, 1915. For electric signs.

1,245,135. DETECTOR; Jim Thompson and Roy J. Thompson, Elk Grove, Cal. App. filed Oct. 18, 1916. Particularly adapted for use with electric generators.